Sustainable Landscapes in Eastern Madagascar

Baseline Household Survey Report[1]

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[1] This document was prepared for the Independent Evaluation Unit (IEU) of the Green Climate Fund by Conservation International (CI) in collaboration with IEU and the Center for Evaluation and Development (C4ED). Team members who worked on this report include Camila Donatti, Giacomo Fedele (CI Moore Center for Science), Clémentine Sadania, Alea Munoz (C4ED), Andoniaina Rambeloson, Clarck Rabenandrasana, Zo Lalaina Rakotobe (CI Madagascar), Jyostna Puri (IEU).

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The household survey was designed, and the data analyzed in conjunction with our colleagues in CI Moore Center for Science, especially with Giacomo Fedele and Camila Donatti. The questionnaire was developed with almost all staff working on GCF Madagascar and GCF Headquarter and was tested in the field in November 2018, in Moramanga (CAZ).

The database was cleaned by the monitoring Team of GCF including, Havana Ranoasy (CI COFAV), Manda Ratsimbason (CI CAZ), and with some help from chief enumerators from CAZ and COFAV.

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ABBREVIATIONS

AE	Accredited Entity
BNGRC	Bureau National de Gestion des Risques et des Catastrophes
C4ED	Center for Evaluation and Development
CAZ	Ankeniheny-Zahamena Forest Corridor
CI	Conservation International
CI-HQ	Conservation International Headquarters
CI-M	Conservation International Madagascar
CLGRC	Comité local de Gestion des Risques et Catastrophes
COBA	Communauté de Base
COFAV	Ambositra-Vondrozo Forest Corridor
ERI	Eco-Regional Initiative
GCF	Green Climate Fund
GIS	Geographic Information System
GPS	Global Positionning System
HH	Household
IEU	Independent Evaluation Unit
INSTAT	Institut National de la STATistique à Madagascar
IUCN	International Union for Conservation and Nature
LORTA	Learning- Oriented Real Time Assessment
M&E	Monitoring and Evaluation
MEDD	Ministère de l'Environnement et du Développement Durable
MIS	Monitoring Information System
MDES	Minimum Detectable Effect Size
ONE	Office National de l'Environnement
PAG	Plan d'Aménagement et de gestion
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RCT	Randomized Control Trial
SLEM	Sustainable Landscapes in Eastern Madagascar
ToC	Theory of Change

VBA	Visual Basic Application
VOI	Vondron'Olona Ifotony

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EXECUTIVE SUMMARY

In this report, we present the findings of the baseline household survey for the project "Sustainable Landscapes in Eastern Madagascar" supported by the Independent Evaluation Unit of the Green Climate Fund (GCF) and implemented by Conservation International (CI). This report provides initial information that will be used to tailor project interventions depending on beneficiaries and context, as well as to monitor the benefits of implemented activities. This report also informs the impact evaluation strategy of the project by comparing the pre-project differences between future beneficiaries and comparison groups, in the context of the Learning-Oriented Real-Time Impact Assessment (LORTA) program of GCF's Independent Evaluation Unit. The project aims to increase the resilience of smallholder farmers and reduce carbon emissions through climate-smart agriculture and sustainable forest management around two protected areas of the Ankeniheny-Zahamena Forest Corridor (CAZ) and Ambositra-Vondrozo Forest Corridor (COFAV).

This report covers the first round of surveys (baseline) conducted from March 2019 to May 2019 with 2730 households in 45 municipalities around the two protected areas. The interviews were conducted with expected beneficiaries of the project and a comparison group in proximity of the project's intervention area. The participants were selected through a stratified random selection following the clustered phased-in approach used for project implementation (Phases 1-3). The comparison group was selected on the basis of municipal and village-level characteristics, using a statistical matching approach. The next two rounds of surveys planned in the coming years will gather additional data that will allow to measure the changes in the livelihoods and vulnerability of farmers that can be solely attributed to the implementation of project activities.

The household survey collected information on various dimensions of the households' livelihoods under climate change impacts. It collected information on characteristics and livelihoods, exposure to shocks, the impact of climate related hazards on farmers lives and livelihoods, their response strategies, food security, access to weather information and climate awareness, opinions on the use and management of natural resources, and access to markets and to markets information. In general, people in the two landscapes appear as highly dependent on subsistence agricultural and animal production (rice, cassava, cows and chicken). Agriculture and animal production were reported to be severely affected by extreme weather events whose frequency and intensity are exacerbated by climate change, such as cyclones, droughts and floods. On average, interviewed farmers lost up to a quarter of their agricultural production due to climate hazards, and skipped at least one meal for two weeks during the last 12 months preceding the survey, used savings, or harvested crops prematurely to respond to the losses in agriculture and animal production. Interviewed households showed a moderate to severe vulnerability to climate change and were, on average, marginally to moderately food insecure.

Farmers also responded to climate-related hazards by building or expanding irrigation systems, practicing agroforestry, using soil conservation measures or intercropping (on average between 40%-70% of the respondents). Around one third of the respondents also use livestock diversification or animal care

enhancement (with vaccination, stable, supplementary feed) as climate change adaptation responses. Several respondents (respectively 55% and 53 % for CAZ and COFAV) reported to have reduced forest degradation to increase their protection to climate hazards, whereas few relied on wild products or sold them in markets as adaptation responses. However, forest degradation and deforestation remain sources of concern and are perceived to have increased in CAZ in the last five years, though a decrease was reported in COFAV during this period. The main barriers preventing farmers to apply more sustainable resilient agricultural practices are a lack of knowledge and skills. Although most of the households have received information about weather, according to respondents such information rarely led to changes in agricultural practices. For those that received information, respectively 64% and 54% in CAZ and COFAV thought that it was not useful, and they believed that this information does not modify their practices (93% for CAZ and 77% for COFAV). Around one quarter of the respondents did not understand the meaning and the impact of climate change and around 40% of them were not aware of the connection between nature and climate, such as the positive contribution of nature in reducing people's climate-related vulnerability.

Most of the households in CAZ and COFAV sell their products in local markets in the municipalities. However, they face several barriers related to distance to market (on average two hours by foot), road conditions, limited production for selling, and lack of collectors or value chains. Most of the households increase their production price by adding value to products through processing (e.g. handcrafts, alcohol), using fertilizers, storing for later use, or changing season or time for cultivation. Most households reported a lack of information about markets and products during the last twelve months that could help guiding decisions on selling their products.

Households defined as part of the beneficiary group were compared with the households that were part of the two comparison groups (household members of phase 3 and the comparison group outside of the intervention area) by the means of mean difference tests. Due to the random allocation of the project beneficiaries in different phases of the program, most of household characteristics are on average similar between phase 1 and phase 3. Despite the attempt of identifying an outside comparison group in communities as similar as possible to beneficiary communities, the results of their comparison reveal some notable differences. The identification of variables differing between these two groups will guide the household matching procedure to be applied in the estimation of the impacts of the project after follow-up surveys.

The findings of this report are informing the tailoring of the project activities and will be used in the preparation of knowledge products for the local communities, national policy makers and researchers. The planned project activities will be further tailored to the specific needs expressed by the farmers in this survey and the factors hindering a sustainable and resilient management of their landscapes. The results presented through this baseline report will be compared with following-up surveys to measure the effects of sustainable landscape practices on the household vulnerability to climate change and on the food security of smallholder farmers that can be attributed to the project activities.

I. INTRODUCTION

a. The LORTA Program

Evaluating the impact of development projects and programs has gained importance within the last years. Following the recent Nobel prize winners in economics, the importance of impact evaluation with experimental and quasi-experimental methods for development projects has been publicly acknowledged as well as its immense contribution to major policy decision making and resource allocation. Rigorous impact evaluations not only allow increased transparency on the effects of investments, but also help design and implement projects more effectively. To contribute to this development, the Independent Evaluation Unit (IEU) of the Green Climate Fund (GCF) has started the Learning-Oriented Real-Time Impact Assessment (LORTA) program. The LORTA program will keep track of GCF projects in terms of performance and results and will enhance learning within the GCF.

The LORTA program aims to:

- Embed real-time impact evaluations into funded projects so GCF project task managers can quickly access accurate data on the program's quality of implementation and likelihood of impact.
- Build capacity within projects to design high-quality datasets for overall impact measurement.
- The purpose of the impact evaluation is to measure the change in key result areas of the GCF that can be attributed to project activities. The LORTA program will not only inform on returns to GCF investments, but also help GCF projects track implementation fidelity. The objectives of LORTA include:
- Measuring the overall change (outcome or impact) of GCF's funded projects and enhance learning.
- Understanding and measuring results at different parts of theories of change.
- Measuring GCF's overall contribution to catalyzing a paradigm shift and achieving impacts at scale.

The first phase of the LORTA program consisted in formative engagement and design. In the first year of the program (2018), IEU supported 8 GCF projects to build high-quality, theory-based impact evaluation designs at inception. Formative work included engagement with project teams, Accredited Entities (AEs), and GCF staff, to design theory-based impact evaluations and protocols for database development. The GCF Madagascar project, Sustainable Landscapes in Eastern Madagascar (SLEM), was selected among the first cohort.

Currently, the LORTA program is in its second phase, which refers to the assessment per se and includes finalizing the baseline data collection and reporting. This will be followed by a third phase that will include analyzing midline and endline data, discussing results and engaging with diverse stakeholders to share results and incorporate feedback as required.

The second phase of LORTA involves a revision of the impact assessment designs developed in the first phase in light of the updated activities and implementation strategy of the project team. Formative engagement is pursued in the form of technical advice on the design and adoption of real-time implementation tracking and measurement systems. For the SLEM project, formative engagement consists in baseline data analysis and reporting collaboratively with the project team and Accredited Entity. The present document is the outcome of this collaboration. In addition to present the SLEM project and its impact evaluation strategy, the present study serves two primary objectives. First, by providing descriptive statistics on future beneficiaries, this report will provide detailed information on key outcomes and related characteristics of the target population of the SLEM program. Second, by comparing the characteristics of the first beneficiary and comparison groups, the evaluation team will assess initial differences between these groups and inform the evaluation strategy of selected project activities accordingly.

b. Evaluation context

The SLEM project aims to increase the resilience of smallholder farmers and reduce carbon emissions by implementing climate-smart agriculture and more sustainable forest management in two landscapes around protected areas (Ankeniheny-Zahamena Forest Corridor and Ambositra-Vondrozo Forest Corridor, referred to as CAZ and COFAV hereafter) (see Figure 1). Project activities related to climate change mitigation, adaptation, capacity building and communication will be implemented for 5 years (2018-2023). The project will target 23,800 households, including members of associations such as the Communautés de Base (COBA) or VOI (Vondron'Olon'IFotony) in Malagasy, Women associations, and PAPs group (People Affected by the creation of Protected Areas), that are expected to benefit from increased resilience and food security as a result of project activities. To assess the effectiveness of the activities implemented on the ground, the monitoring and evaluation team have put in place a Monitoring and Evaluation (M&E) system that will track changes on the outputs and outcomes of the project. This system was primarily built based on the Logic frame of the program, on Theories of Change (TOC) and on the Indicator Performance Tracking Table (IPTT).

The household survey is a crucial component of the M&E System, on which the LORTA assessment will be mostly based on. The information collected through the surveys will provide the basis to measure and understand changes in household outcomes as a result of project activities and to assess the effectiveness of the activities implemented on the ground. The data collected through the surveys will provide the information on key adaptation, mitigation, communication, and capacity building indicators and will be used to assess and communicate the outcomes of the SLEM project.

There will be three rounds of household survey during the SLEM project: Baseline survey (March 2019 - May 2019), Midline evaluation household survey (March 2021 - May 2021); and Endline evaluation household survey (March 2022 - May 2022). The data collection will follow the sampling design for the impact evaluation that allocated the household surveys in three groups (Phases 1 and 3 and control, see next section for more information).

The impact evaluation of the SLEM project focuses on adaptation and mitigation activities. This evaluation will primarily rely on household surveys conducted during the timespan of the project, but qualitative interviews will also be conducted. Secondary data (satellite images) will be an essential part of the evaluation of mitigation activities.

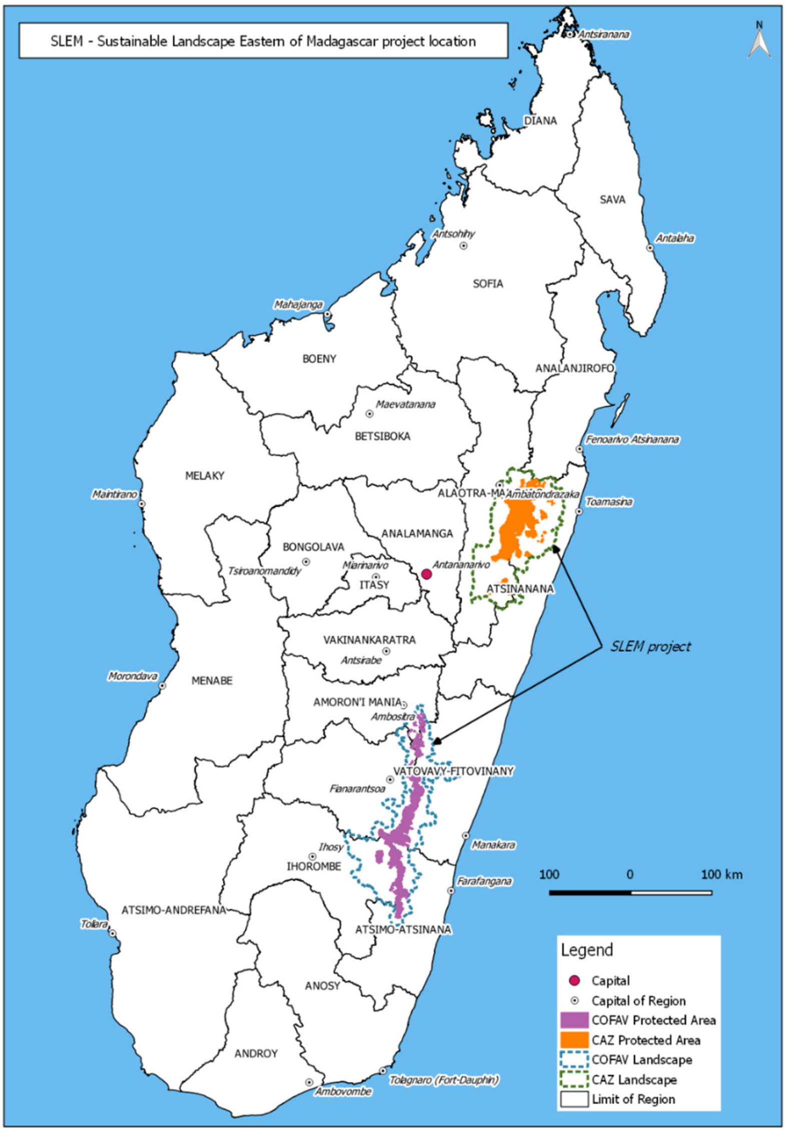


Figure 1. Location of the two landscapes targeted by the project SLEM

Sustainable Landscapes in Eastern Madagascar: CAZ (Ankeniheny-Zahamena Corridor) and COFAV (Ambositra-Vondrozo Forest Corridor).

c. Objectives of the household survey

The household survey is the primary source of quantitative information on the livelihoods, the impact of the climate-related hazards, and the response strategies of the people that will benefit from the project activities. This information will be used for several purposes:

1. To provide baseline values on outcomes of interest and measure the effects of sustainable landscape practices on household vulnerability to climate change and food security after 2 years (2021) and after 3 years (2022) of to the implementation of project activities. The baseline survey on which this report is based is also used to inform the impact evaluation strategy of the project by assessing initial differences between future beneficiaries and comparison groups.

2. To support CI Madagascar with information to tailor project interventions depending on beneficiaries and context, as well as monitor the benefits of implemented activities.

3. To inform the Madagascar Government on community-based resource management initiatives that improve climate change adaptation and mitigation through technical and policy recommendations on sustainable landscape measures.

4. To provide evidence on the effectiveness of Ecosystem-based Adaptation (EbA) and other natural climate solutions in helping farmers adapt to climate change, which will be summarized in scientific articles and technical reports.

5. To increase awareness of project beneficiaries on sustainable landscape practices and their motivation to continue to use them. We will be sharing key results of the household surveys regarding the state of the community well-being and the environment with the project's target communities, as well as the satisfaction with project activities.

The remaining of this report is organized as follows. Section II is dedicated to the SLEM program and presents the intervention area, the key components and objectives of the project. Section III introduces the impact evaluation strategy of the adaptation and mitigation activities of the SLEM project. Section IV reviews the household survey methodology. Section V will present the statistical analysis of the baseline household survey Section VI will present Results on the Climate change vulnerability in the two sites, SECTION VII will present results on food security, SECTION VIII, will present balance test results before ending on conclusive remarks in Section IX conclusions and recommendations.

II. THE SUSTAINABLE LANDSCAPES IN EASTERN MADAGASCAR PROJECT

a. Project sites at glance

The project is implemented in CAZ and COFAV. These two corridors are the remaining big blocks of forest in the Eastern part of Madagascar. CAZ has a total of 370,00 ha covering 5 districts, whereas COFAV has a total of 290,000 ha covering 10 districts (see Table 1). The two corridors are characterized by a mosaic of low-land humid tropical forests and agricultural lands with rice, cassava and maize as primary crops. CAZ and COFAV areas are incredibly rich in diverse and endemic species. In CAZ, over 2,043 species of plants have been identified, of which 85% are endemic. These forests offer the habitat for fifteen species of lemurs and thirty other species of mammals, as well as 129 species of amphibians and 89 bird species. Several lemurs are threatened, such as *Indri indri*, *Varecia Variegata variegata*, and *Propithecus diadema.* In COFAV, there are over 800 species of plants and 300 species of animals, including 17 species of lemurs, two of them are highly endangered (*Hapalemur aureus* and *Prolemur simus*). Moreover, those sites are important in terms of water provision and forest cover and characterized by a high dependency of local population on forest resources for their livelihood[2] . They are also important sources of minerals, gemstones and gold.

Following the national process for the creation of new protected areas, several public consultations have been conducted in districts, communes and regions together with local populations. This process led to the definition of the different boundaries of the protected areas (Core Zone, Sustainable Zone, Area of Occupation). After submitting the required documentation for the creation of the protected area, CAZ and COFAV received a temporary protection status in 2005. The CAZ and COFAV are classified respectively in category VI (Natural Resources Reserve) and V (Harmonious Terrestrial Landscape) following the International Union for Classification and Nature (IUCN) categorization. The temporary status has been reinforced by a global protection of all future protected areas in 2008 and 2010 through the "Arrêté 522005/2010 du 20/12/2010". The areas are now officially protected since April 27th, 2015 when the National Office of the Environment (ONE) has delivered the Environmental permit.

[2] Plan Aménagement et de Gestion CAZ, 2015, Ministère de l'Environnement, de l'Ecologie, de la Mer et des Forêts & Conservation International, 2015. Plan d'Aménagement et de Gestion de la Reserve de Ressources Naturelles du Corridor Ankeniheny-Zahamena. 69pp.

Plan d'Aménagement et de Gestion PAG C, 2015. Ministère de l'Environnement, de l'Écologie, de la Mer et des Forêts et Conservation International, 2015, Plan global d'aménagement et de gestion du Corridor Forestier Ambositra - Vondrozo, 85p

Table 1. Overview of the two project areas

	CAZ	COFAV	TOTAL
Protected Area (ha)	369,909	291,000	660,909
Population (in communes)	394,349	569,123	963,472
Households (in communes)	65,725	94,854	160,579
Population (in fokontany)	128,122	209,294	337,416
Households (in fokontany)	21,354	34,882	56,236
District	5	10	15
Municipalities (or commune)	28	45	73
Fokontany [3]	89	161	250
HH/Commune	2,347	2,108	4,455
Average HH/in fokontany	240	217	457

Sources:

Protected Area: Madagascar Government and Conservation International
Populations estimates for 2015 adjusted to match total UN population division estimates. WorldPop. 2017. Madagascar 100m Population, Version 2. University of Southampton. DOI: 10.5258/SOTON/WP00535.
Assumption: 1 HH = 6 people on average (regional data)
Administrative boundaries: Madagascar Government (National Disaster Management Office) and UN OCHA 2017.

The climate in the Eastern part of Madagascar is tropical with a dry season that spans between April and September and a rainy season that spans between November and March. Smallholder farmers in these places are affected by frequent cyclones that cause heavy rain, strong winds and flooding. In the last 10 years, both corridors have experienced several anomalies in precipitation patterns with several period wetter than usual and some drier than usual, especially in the most recent years (see Figures 2 and 3). The frequency and intensity of the cyclones are expected to increase by the end of 2100 because of climate change (IPCC 2014).

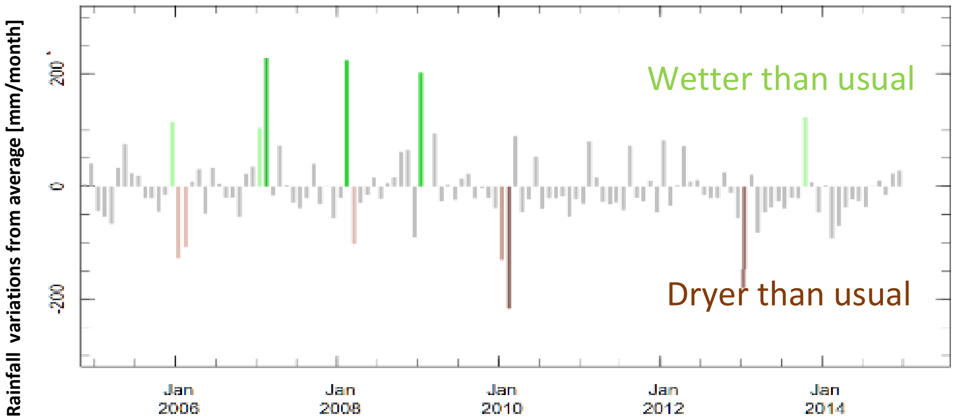


Figure 2: Precipitations anomalies in COFAV.

(Source: NASA GES-DAAC/TRMM v7 (Tropical Rainfall Measuring Mission) (1998-2015), anomalies represent the difference from the average over the entire period)

[3] The municipality is a basic decentralized community with its body the mayor and councilors elected by direct universal suffrage and freely administer the municipality. A fokontany is a basic administrative subdivision at the municipality level. The fokontany, depending the size of the settlements, includes hamlets, villages, sectors.

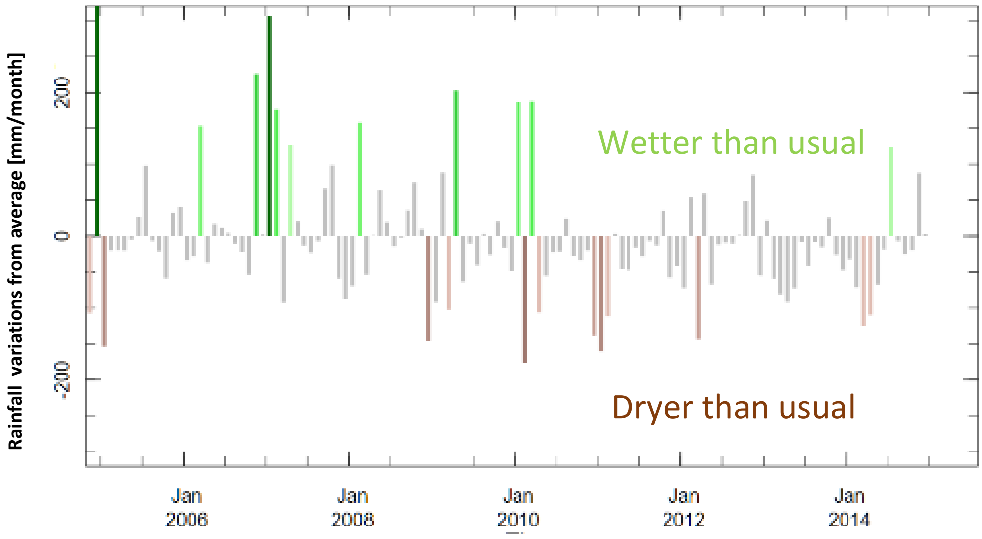


Figure 3: Precipitation anomalies in CAZ.

(Source: NASA GES-DAAC/TRMM v7 (Tropical Rainfall Measuring Mission)

(1998-2015), anomalies represent the difference from the average over the entire period)

The population living around these two forest corridors are highly dependent on agriculture for their livelihoods. The populations living around CAZ are mainly from three different ethnicities, in the North Western part: Sihanaka, in the Southern Western part: Bezanozano, and in the Eastern part: the Betsimisaraka. Most of the population in the CAZ landscape (surrounding the external boundaries of the Protected Area) is living under precarious situations, with households earning on average 300,000 MGA, or around 80 USD per month. People surrounding CAZ have been collecting yams, sweet potatoes, honey or forest material for making handcrafts, as well as shrimps, fish and eels in rivers. Forest products including firewood are also complementary income activities. The population in CAZ is mostly practicing agriculture for their livelihood. The Betsimisaraka are practicing slash and burn agriculture because they have narrow wetland rice fields, whereas the Sihanaka are wetland or lowland rice growers coming from the Alaotra lake and are cultivating fertile land in valley and plains. This practice is called “rain-fed rice cultivation” or “culture de riz pluvial” in French. The exceeding agricultural production, especially for rice, cassava, beans, corn and peanuts, is sold on the local market in village. They also cultivate banana, cloves, ginger and litchi, with limited transportation to the regional market due to inexistence of roads, isolation and poor accessibility. Local people also practice poultry and cows herding (only few of them). The farmers living in these areas face many diseases that affect chicken, cows, and pigs (such as pig plague, pasterellosis, chicken cholera, newcastle disease, chicken smallpox).[4]

The main ethnic populations in the COFAV landscape are the Tanala, Betsileo Bara and Sahafatra. Most of the people cultivate rice, cassava, coffee, beans, litchis and banana. In addition, they produce a local alcoholic beverage (rum) and collect crayfish. Since 2013, there has been some changes in how people cultivate rice in this region. Many households have abandoned rice cultivation through slash and burn and

[4] Plan Aménagement et de Gestion COFAV, 2015, Plan d’Aménagement et de Gestion PAG CAZ, 2015.

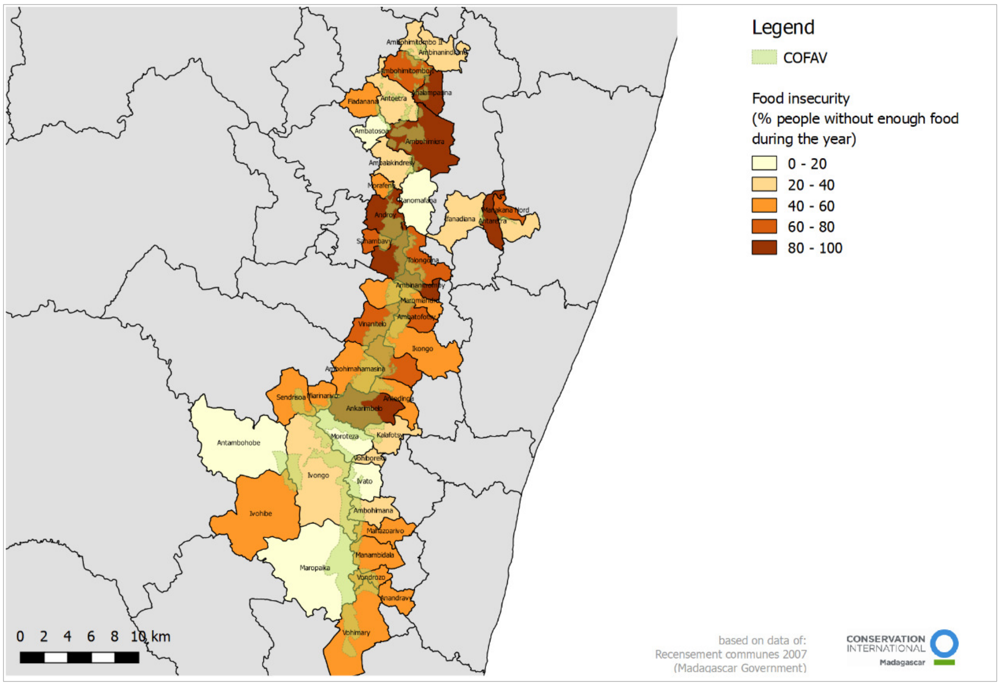
instead grow rice for subsistence because of the limited productivity of the soil. Cassava and banana are also mainly for household consumption. Sugar cane is also cultivated for brown sugar traditional production, or for alcohol fabrication. Ginger cultivation also became popular in the past few years. Vanilla and pepper were introduced by families because these crops are well adapted to local climate. [5]

Although the ethnic composition of the population living in CAZ and COFAV determine the socio-economic characteristics and cultural aspect of the regions, and each commune has its own specificity, CAZ and COFAV have some common characteristics:

- Roads in bad shape, or just rudimentary (artisanal paths);
- Households with young household head and high proportion of young children;
- High illiteracy rate, and few schools available;
- Lack of hospitals nearby and center for basic diseases treatments, with people using traditional medicines and plants to heal diseases and illnesses;
- Ancestral practices of agriculture and small herding; and
- Have two or more sources of incomes, with the secondary income might be handcrafting or charcoal production

Smallholder farmers in CAZ and COFAV are often affected by climate-related hazards that reduce their harvests and lead to shortages of food, as well as further deforestation. Existing data at municipality level from 2007 (the most up-to-date National Survey of the Municipalities) indicates that there are several municipalities in both CAZ and COFAV where almost all population do not have enough food throughout the year (see Figure 4). The lean season lasts on average about 3.8 months from December to March.

[5] Plan Aménagement et de Gestion COFAV, 2015, Plan d'Aménagement et de Gestion PAG CAZ, 2015.



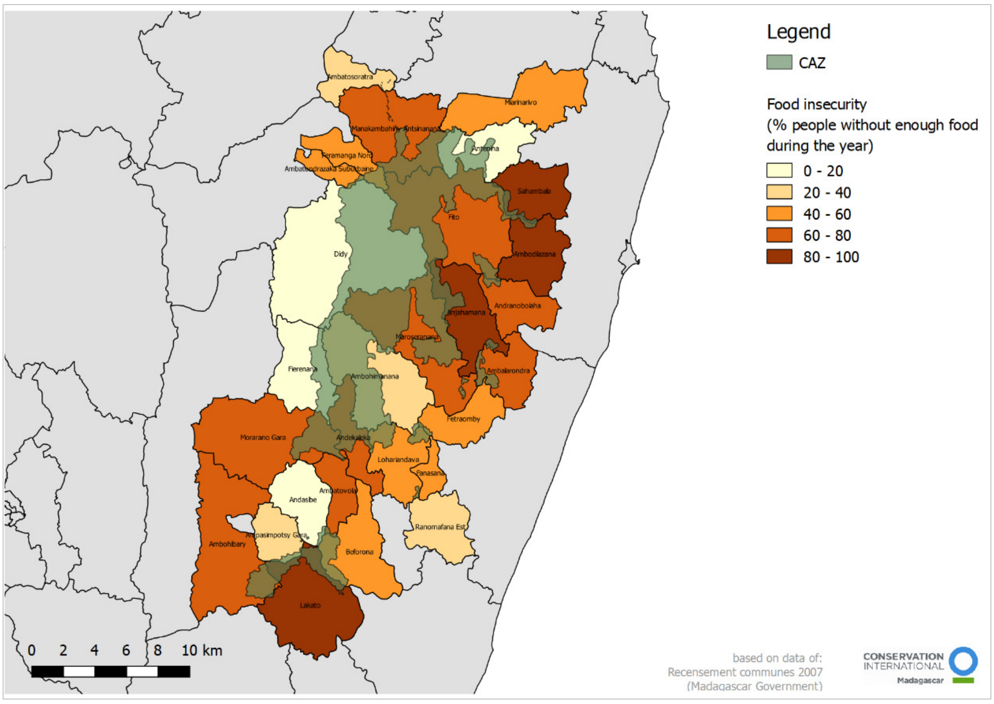


Figure 4: Food insecurity in municpalities in COFAV (above) and CAZ (below) landscapes

b. The Sustainable Landscapes in Eastern Madagascar Project

The vision of the SLEM project is to facilitate a development pathway to help smallholder farmers to move out of a vicious cycle of resource depletion and increased vulnerability (see Figure 5). To achieve this, the project interventions of CI will focus on working directly with farmers in CAZ and COFAV to develop resilient farming communities (see Figure 6; blue boxes). Those interventions are designed to provide direct support to vulnerable smallholder farmers with the tools and inputs needed to adopt sustainable agriculture techniques, and to strengthen capacities of smallholders on climate change mitigation and adaptation, community-based organizations and the local government in the two landscapes. In this way, the project activities will allow households to progress from a situation of high vulnerability and no engagement with markets to a situation where farmers are thriving, even if in face of climate change, and have a continued engagement with markets.

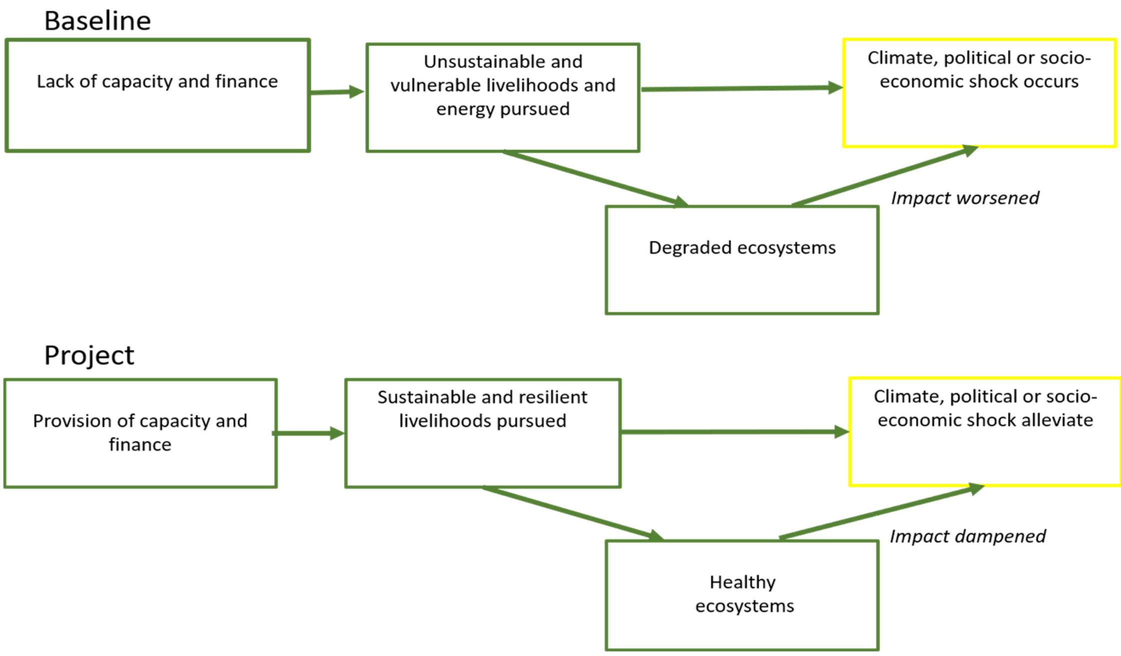


Figure 5: Vision of the SLEM project

Note: Rural Madagascar is lagging behind the rest of the country with most smallholder households vulnerable to extreme weather, market and political forces. The project's vision is to facilitate a pathway out of a vicious cycle of resource depletion and increased vulnerability.

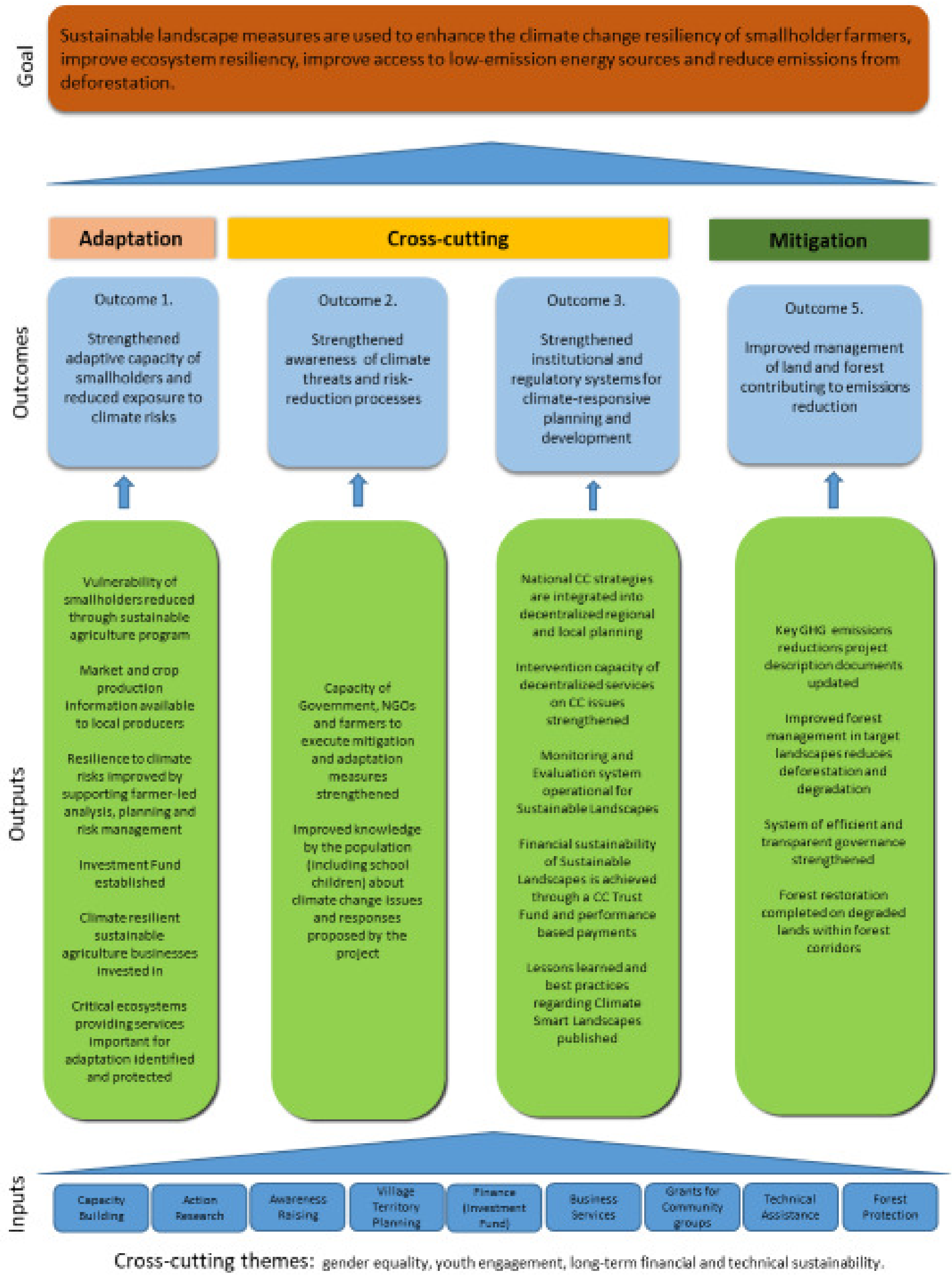


Figure 6: Project goals, outcomes and outputs

III. IMPACT EVALUATION DESIGN

a. Theories of change of adaptation and mitigation activities

1. Adaptation

One of the key goals of the project is to improve the food security of smallholder farmers and reduce their vulnerability to climate change in CAZ and COFAV by implementing climate smart agriculture practices and ecosystem-based adaptation measures (see Figure 7). The project activities targets the smallholder communities within the CAZ and COFAV landscapes and will use gender-sensitive households surveys to identify climate risks and location-specific adaptation measures used. In addition, project activities will also include a participatory planning aimed at protecting or restoring important habitats for farmers' adaptation, such as vegetation providing erosion control and forest areas around water catchments ensuring continued water provision. Furthermore, to improve the long-term food security and reduce vulnerability of smallholders, part of the activities will strengthen the ability of smallholder farmers to engage with markets by both accessing finance when needed and being able to sell their products with added value. Service centers for storage and sale are also projected as well as processing units that will help farmers to add a monetary value to their products. Moreover, the project will develop training modules on Ecosystem Based Adaptation and agricultural techniques, and provide training for government and civil society organizations, universities and community groups. The project will also support local existing risk management structures (*Comité local de Gestion des Risques et Catastrophes* or CLGRC: Local Committee for risk management) and create new ones at the level of commune, to reduce exposure to climate risks.

2. Mitigation

Another key goal of the project is to improve the management of forests, including their protection and restoration, to decrease carbon emissions (see Figure 8). These activities aim to reduce carbon emissions from deforestation and forest degradation in CAZ and COFAV by training local communities about the benefits from participatory well-managed forest resources and providing sustainable livelihoods without damaging the forest such as agroforestry and conservation agriculture. Activities under the mitigation component of the project are mainly the following:

- Demarcate and maintain the protected areas boundaries (external boundaries and for the core zone), to allow people to recognize the officials limits of the protected area and to protect the forest; Boundaries of the protected areas were defined with stakeholder's participation based on Land Use Plan developed through the scientific analysis on biodiversity, forest, social and economic data.

- Conduct mixed brigades/ support prosecution of offenses; In case of an emergency for illegal forest incident, key stakeholders from Local authorities and senior staff from the decentralized technical services such as the Regional Directorate of Environment and Sustainable Development (MEDD) and other Directorates from the Gendarme, the Tribunal, and Ministry of Agriculture, Livestock, and Fisheries must conduct the forest control to solve issue related to the forest protection.

- Conduct patrolling and participatory Ecological monitoring within CAZ and COFAV. The MEDD and the VOI signed a contract agreement for managing local forest and the project has provided technical training, per-diem and field supplies to the local forest communities or associations called VOI to conduct and report forest patrolling activities within their own forest. In addition, training on the benefits from forest ecosystem services such as carbon sink, source of water for drinking and watering crops has provided.

- Strengthen local capacity of structures on technical, legal and management aspect of restoration and put in place conservation agreements. The project provides training to conduct nursery and tree plantation and the national policies for forest restoration management. Local communities or associations have received in-kind grants to improve their yields and incomes and the project will find buyers for their products. It is written under the in-kind grants agreement that the local communities are not allowed to destroy forest or use inappropriately the forest resources and must conduct tree plantation.

- Support local forest management structures; Training related to the structure management of their associations have been provided: they should have a President for the association, a management staff, an annual plan and report.

- Support the Regional Directorate of Forest through providing equipment such as laptops, GPS, and field supplies that they can use during the forest control.

- Support the update of Management plans for CAZ and COFAV; Every 5 years, the project has to update the Protected areas management plan and it must be done by the year 2020.

Local communities are involved in local enforcement and monitoring of threats to the forests. CI will provide direct payments to local people working on the conservation of the areas. In addition to the forest protection activities, this outcome includes planned forest restoration in degraded areas within the forest corridor providing mitigation and adaptation benefits. These combined activities are intended to encourage more productive land uses over the medium- and long-term

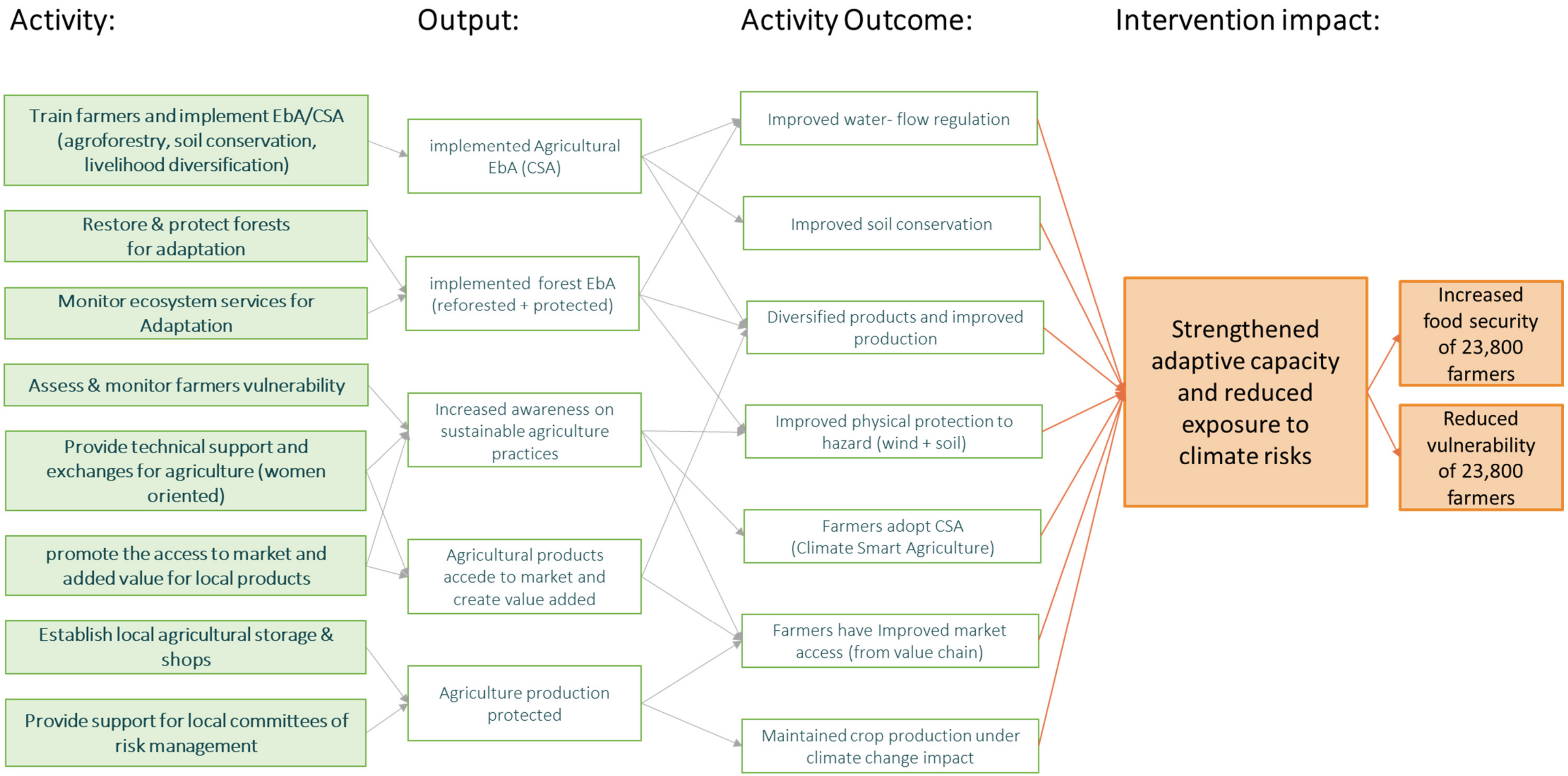


Figure 7: Theory of change of the adaptation activities to be implemented by the project, their outcomes and their association with interventions and project goals.

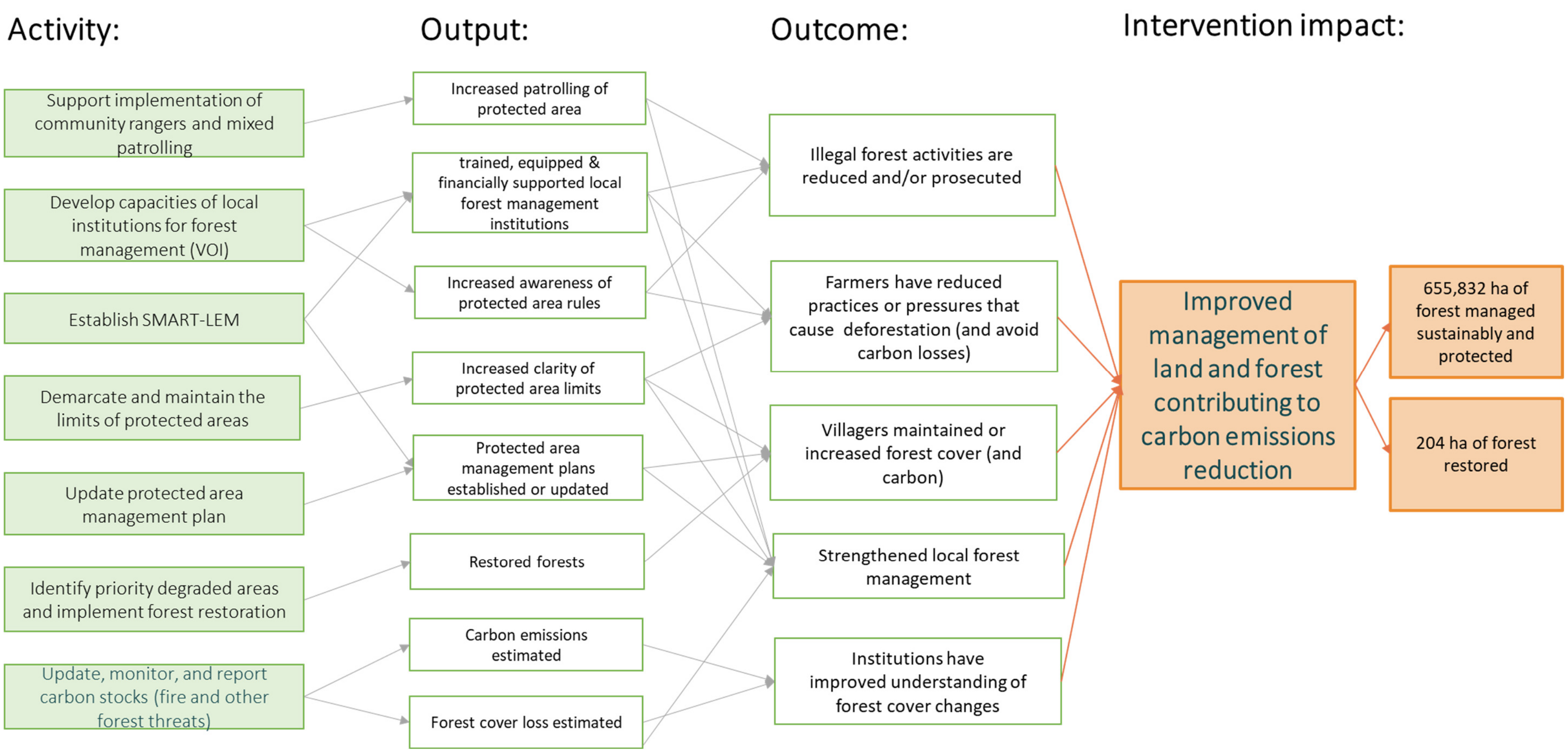


Figure 8: Theory of change of the mitigation activities to be implemented by the project, their outcomes and their association with interventions and project goals.

3. Key evaluation questions and indicators

Our hypothesis is that the implementation of the sustainable agricultural interventions as part of the project will reduce the climate change vulnerabilities of smallholder farmers and increase their food security and the implementation of mitigation activities will improve management of forest and contribute to carbon emission reduction. We will test these hypotheses by answering the following research questions:

- Have the food security and vulnerability to climate change of smallholder farmers changed after project benefits were implemented in CAZ and COFAV?
- Do changes in vulnerability and food security depend on the sustainable management practices that are implemented in the farm?
- What sustainable management practices to reduce farmers vulnerabilities to climate change and increase food security were perceived as most effective?

Evaluation questions

To contribute to answering these key research question, the impact evaluation of the SLEM project will seek to answer the following evaluation questions:

Related to adaptation activities:

- Do adaptation interventions lead to an increase in the number of livelihood strategies used?
- Do adaptation interventions lead to an increase in the number of conservation agriculture practices implemented?
- Do adaptation interventions lead to a reduction of households' vulnerability to climate hazards?
- Do adaptation interventions lead to an increase in agricultural production and food security?
- Do changes in vulnerability and food security depend on the sustainable management practices that are implemented in the farm?

Related to mitigation activities:

- Do patrollers cover the designated area during patrols? How much area out of total protected forest area in the region is not covered by patrolling?
- Do patrolling interventions lead to a better enforcement of regulations of the forest protected area?
- Do patrolling interventions result in a reduction in deforestation?
- Does deforestation increase in other areas as a result of an increase in forest surveillance in the target areas?

Analyses of monitoring data, the different rounds of household surveys and secondary data (satellite images) will help answer these key evaluation questions. To do so, we will assess changes in the following key indicators, most of them collected during baseline, midline and end-line household surveys:

Related to adaptation activities:

- Number of farmers who diversified their livelihoods
- Number of crops, animal and forest/tree products used by the household
- Number of farmers who implemented conservation agriculture practices
- Number of conservation agriculture practices used by farmers
- Damages in agricultural, forest and livestock product following climate hazards
- Share of the agricultural production not used for household consumption
- Quantities produced of three main crops, animals, forests/tree products
- Food security index based on food consumption, food expenditure shares and the number of strategies to cope for a lack of food.
- Vulnerability index based on exposure, sensitivity and adaptive capacity of farmers
- Number of days members of the household did not eat three meals a day

Related to mitigation activities some indicators will be obtained from M&E data such as:

- Distance covered by patrollers
- Number of days per person and per month spent in patrolling
- Percentage of reported violations prosecuted by authorities
- Self-reported inappropriate use of forests
- Deforestation in target and nearby areas, measured by satellite images
- Land use, measured by satellite images
- Carbon emission, measured from deforestations through satellite images

b. Impact evaluation design

The proposed methodology follows a mixed-method approach that combines quantitative and qualitative data analysis. The quantitative evaluation will be based on both an experimental and a non-experimental design. Combining the experimental and non-experimental approaches in a complementary fashion will allow increasing the time-span that the research covers. A cluster randomized phase-in will serve in the identification of the short-term effects of the adaptation activities of the SLEM program. For the estimation of longer-term impacts, a difference-in-difference approach combined with matching will be used. Additional qualitative data will be collected in the form of key informant interviews and focus group discussions. The complementary qualitative analysis will help us to further understand for whom and why interventions work or do not work. Qualitative analysis will also be used to assess the gender sensitivity of the SLEM interventions.

1. Short-term impacts: Phased-in cluster randomized control trial

A cluster randomized phase-in is an experimental design that relies on the randomization of the order in which each eligible cluster receives the program activities. All eligible VOI of the SLEM program will eventually receive the interventions. Thanks to a roll-out in several stages, it was possible to randomly select the order in which these eligible VOI participate in the program. Clusters randomly assigned to a later phase serve as the comparison group until they start receiving the interventions.

The main unit of assignment of the SLEM program is the VOI. In order to avoid social conflicts within VOI, the evaluation team opted for a cluster randomization, with the VOI being the *cluster* of farmers that will be randomly allocated into the different phases of the program. An additional advantage of a cluster randomized design is to avoid the contamination of the comparison group. As an experimental approach, a cluster randomized phase-in is the strongest method of evaluation of the impact of the SLEM program.

The Adaptation component of the SLEM program will be implemented in three phases for VOI and associations. The first implementation phase began in July 2019 and will end this December 2019, for phase 1. However even the VOI of phase 1 received donation of materials and inputs this year, CI support will be continuous, as technical support will be provided to communities until the end of the project, and they will receive other inputs also in 2020. Because the main outcomes of interest of the program, namely food security, climate change vulnerability and deforestation, are expected to evolve slowly over time, an evaluation at the end of the first phase is not cost-effective. The impact evaluation design will hence focus on the first and third phases of rollout with a total of one-and-a-half years between completed intervention and evaluation. The phase-in design will hence measure only the short-term impacts of the program. Due to the limited total program period of five years, spacing between phases could not be increased in order to capture longer-term impacts.

In addition to the velocity of measurable progress in outcomes, limited randomization possibilities in certain communities fostered the decision to exclude phase 2 from the evaluation. Indeed, some communities could not receive the program in the first phase, for instance because of the insecurity and difficulty of access to the areas. Therefore, these communities had to be taken out of the impact evaluation sample. By excluding the second phase from the impact evaluation design, those communities excluded can receive project activities during from 2020 without undermining the impact evaluation strategy of the SLEM project. Therefore, only communities in phases 1 and 3 will be considered in the household survey analysis. Impacts of the SLEM projects will be measured by comparing in 2021 the outcomes of households who received project adaptation activities in 2019 (phase 1) with the outcomes of households who have not yet received project adaptation activities (phase 3).

2. Long-term impacts: Difference-in-difference with matching

To estimate longer-term impacts of the project, the evaluation team turns to a quasi-experimental design as an informative, though less robust, complementary strategy. The difference-in-difference approach estimates project effects through the comparison of changes in outcomes over time between beneficiaries and a comparison (control) group. As every VOI located in the intervention area will ultimately receive the program, this comparison group will be composed of households in communities where no VOI exists. Because the formation of VOI and membership are not random, beneficiaries and the comparison group are expected to differ at baseline. Therefore, a pure ex-post comparison of both groups does not allow us to recover the effects of the program. Instead, the evaluation team will compare changes in outcomes between the two groups, acknowledging potential initial differences.

A difference-in-difference design accounts for initial observable and unobservable differences between the beneficiary and comparison groups. This approach is also robust to external shocks, if these shocks affect both groups similarly. The crucial assumption of this technique is that the change in outcomes in the treated and comparison groups would have been the same without the intervention.

The difference-in-difference design considers VOI randomly assigned to phase 1 as the beneficiary group. The geographical scattering of this group, reproduced within the comparison group, reduces the probability that any systematic time-varying difference arises between the two groups due to external shocks. Indeed, because of their geographic dispersion, external shocks are less likely to affect only one of these groups. The validity of this assumption is further reinforced the most similar the two groups are at the beginning of the project. Therefore, the evaluation team complemented this approach with matching at two levels: at the community level and at the household level.

Matching consists in using statistical techniques to construct an artificial comparison group. The idea is to select, for every treated unit, a non-treated unit that has the most similar observable characteristics. The evaluation team first opted for matching at the community level. Based on the baseline data, the evaluation team is able to identify initial differences in observable characteristics between VOI members and this comparison group. These characteristics will be used to match beneficiaries with non-beneficiaries using propensity-score kernel matching. These variables will allow us to predict the probability to receive one of the project benefits, this probability being referred to as propensity scores. Then, each household will be compared to households having the most similar probability of participation (comparison group), by giving more weight to comparison households whose propensity score is the closest to their own, and a lower weight to comparison households whose propensity score is more dissimilar.

All VOI of the zone of intervention start to receive mitigation activities. We hence need to turn to a quasi-experimental design for the evaluation of this component. Main analyses will be based on satellite imagery using matching and regression methods (Blackman, 2013).

IV. Survey Methodology

a. Selection of sample areas

1. Selection of sample area for the Randomized Control Trials (RCT)

To account for the geographic heterogeneity of the area of intervention and of the size of the forest covered by VOI, the evaluation team opted for a stratified randomization for the sample selection. The stratification was based on four geographic areas –namely, the north and the south regions of COFAV and the eastern and western regions of CAZ-, three quantiles of the surface of the forest covered by VOI, and two quantiles of the size of VOI, measured by the estimated number of group members. The stratification ensures that proportion of each of these regions and groups is similar across the phases of project implementation. Two advantages arise in doing so. First, by gaining control of the composition of the sample, the estimation of the impacts of the project is improved. Second, it ensures that sub-groups are represented in each phase. From the pool of VOI eligible to randomization, 51 VOIs were randomly assigned to the first phase and 50 VOIs to the third phase of the program (see Figure 9 and Figure 10). Remaining VOIs not eligible to randomization[6] were allocated to the second phase and opted to be excluded from the evaluation sample.

2. Selection of the longer-term comparison group

Comparison areas are selected based on the characteristics of the fokontany hosting VOIs assigned to phase 1, using statistical matching. A first pool of communities in the fokontany that do not host VOI was selected relying on the expertise and local knowledge of the project team. From this pool, communities within 5 km to protected areas were selected and statistical matching was performed using distance to secondary roads, exposure to climate hazards (floods and droughts), density of population, food security and dependency on forest resources. Fokontany selected as a comparison area are represented in Figures 9 and 10. Within the identified communities, households not involved in agricultural activities are excluded.

[6] Some VOI were receiving other CI interventions and were not eligible to the SLEM program.

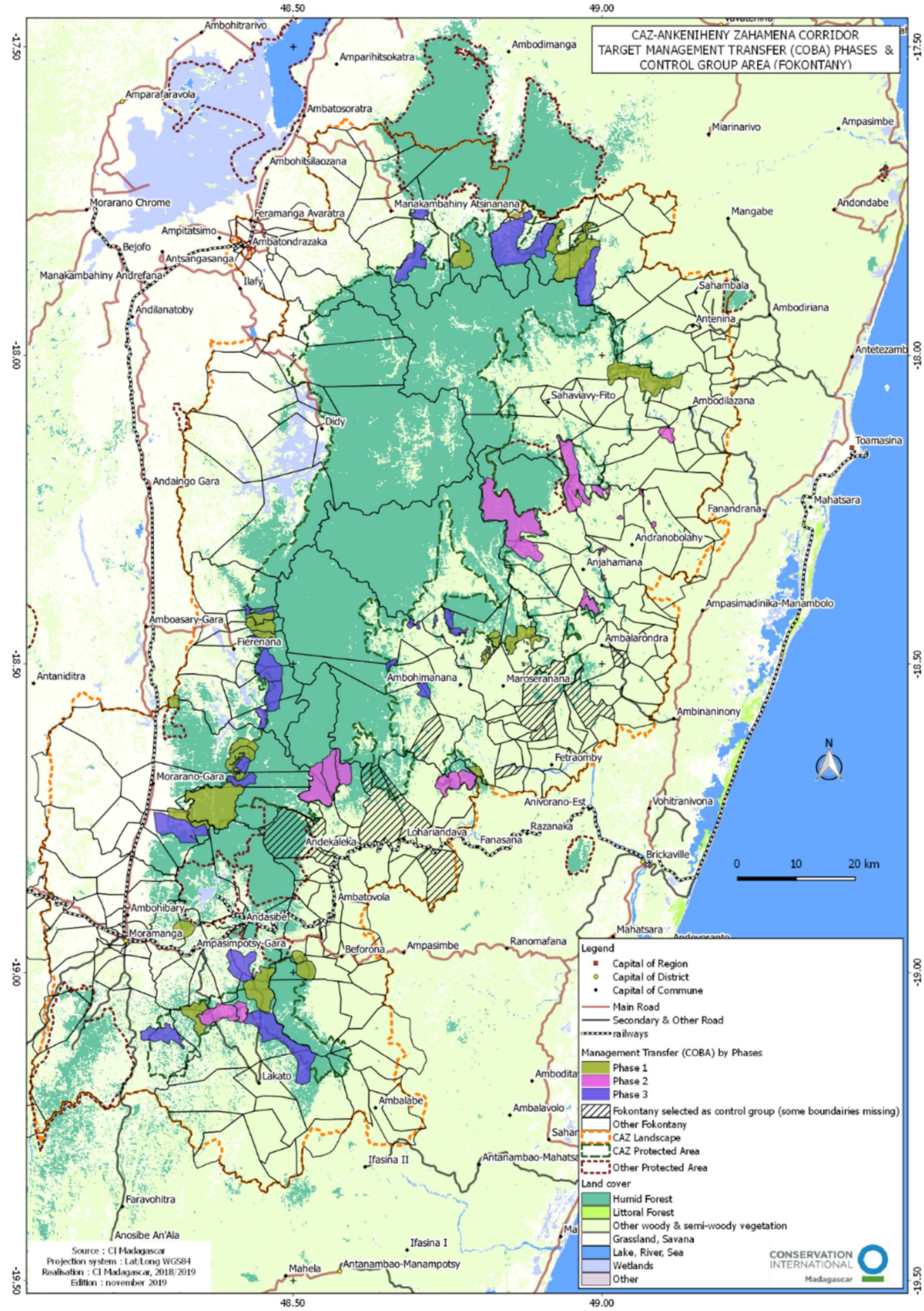


Figure 9 : Map of areas selected for phase 1, phase 3 and the outside control group in CAZ

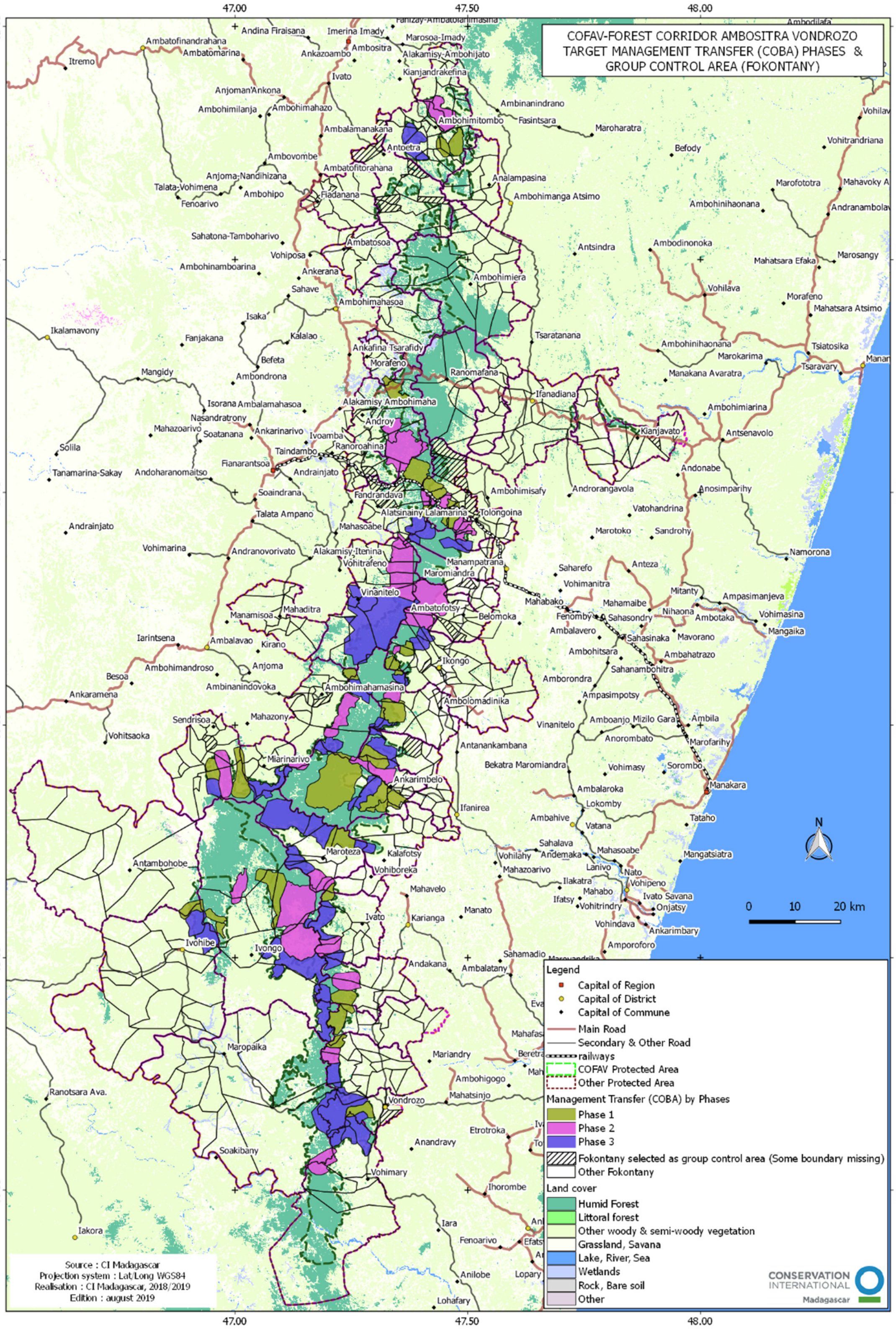


Figure 10: Map of areas selected for phase 1, phase 3 and the outside control group in COFAV

b. Baseline sampling and power calculations

Power calculations are performed by the evaluation team in order to estimate the Minimum Detectable Effect Size (MDES) for household survey baseline sampling, considering the constraints of the SLEM project. These constraints consist in the number of clusters in which the project will be implemented during each phase (50 VOI) and in budget constraints for data collection.

As we are interested in two bilateral comparisons, between the first beneficiary group (VOI members from phase 1) and the comparison group within the area of intervention (VOI members from phase 3), and between the first beneficiary group and a comparison group outside the areas covered by VOI (the diff-in-diff control group), the MDES needed to be estimated separately for each of these comparisons. Considering an equal allocation ratio between these three groups, the maximal sample size within budget constraints for each comparison is equal to 1652 households.[7]

The MDES is calculated with the following formula:

$$MDES = (t_{1-\kappa} + t_{\alpha})\sqrt{\frac{1}{P(1-P)}}\sqrt{1+\rho(m-1)}\sqrt{\frac{\sigma^2}{N}}\sqrt{1-R^2}$$

where $t_{1-\kappa}$ and t_{α} are t-statistics representing the required power and level of statistical significance, P represents the proportion in one of the two compared groups (allocation ratio), ρ is the intra-cluster correlation (ICC), m is the number of individuals per cluster, σ^2 is the variance of the outcome of interest within our population, N is the total sample size and R^2 represents the extent to which baseline characteristics predict the endline outcome.

The MDES is estimated for a power of 80% and a level of statistical significance of 5%. Since we consider a cluster design, we accounted for the similarity of members within the same VOI. This similarity is measured by the intra-cluster correlation, which compares the variance in outcomes of interest (for this calculation, food insecurity) within clusters and between clusters. When the similarity in outcomes within clusters increases and there is heterogeneity across clusters, the variability of the responses of households to the interventions reduces. As a result, the sample size required to detect a significant difference between the treated and the control group increases. Because there was no quantitative data on food security and vulnerability at the VOI level prior to the baseline household survey, following the literature the evaluation team considered three different values of ICC: 0.05, 0.10, 0.15 and 0.20.

To estimate the variance of outcomes of interest, the evaluation team used the Afrobarometer 2017, a nationally representative household survey. This survey contains information on one proxy of food insecurity, one of the main impact indicators of the SLEM project. The evaluation team considered an indicator equal to 1 if the interviewed individual reported that she/he or a member of her/his household often or always lacked food during the last 12 months and 0 otherwise. According to the food insecurity

7 Note that in a case where the number of clusters cannot be increased, an equal ratio is optimal. Indeed, although the treated group will be used in two types of bilateral comparisons, the benefits obtained from increasing the size of these bilateral samples is counteracted by the increase in the average cluster size.

information from Afrobarometer, 55% of individuals residing in the regions that include the COFAV and CAZ landscapes are food insecure. The standard deviation is equal to 0.50.

Table 2 shows the results of power calculations assuming different values of ICC.[8] According to the most conservative scenario, the change in food insecurity brought by the project will need to be as large as 25% to be identified. In other words, smaller changes may be interpreted as an absence of impacts of the project on this indicator. However, according to documented impacts of previous agricultural input innovations programs in Africa, this minimum effect size be a reasonable lower bound of the expected impacts of the SLEM program on food security (for instance see Stewart et al., 2015).

Table 2. Power calculations

Indicator	ICC	# of clusters per group (VOI)	Total sample	R2	Size of clusters # of HH	MDES (in % points)	% change in food security
Food insecurity	20%	50	**2478**	**30%**	16,52	0,116	21,2%
Food insecurity	20%	50	**2478**	**0%**	16,52	0,139	25,3%
Food insecurity	15%	50	**2478**	**30%**	16,52	0,105	19,1%
Food insecurity	15%	50	**2478**	**0%**	16,52	0,125	22,8%
Food insecurity	10%	50	**2478**	**30%**	16,52	0,092	16,7%
Food insecurity	10%	50	**2478**	**0%**	16,52	0,110	19,9%
Food insecurity	5%	50	**2478**	**30%**	16,52	0,077	13,9%
Food insecurity	5%	50	**2478**	**0%**	16,52	0,091	16,6%

c. Questionnaire design

The household survey questionnaire was developed by CI, led by the Adaptation Team in Washington DC (CI-Moore center), in September 2018. All the main technical staff involved in the project as well as IEU and C4ED had the opportunity to provide comments and suggestions to initial drafts. The project team also followed CI internal procedures for the ethical conduct of research that included t training and the development of data management plans.

The questionnaire includes 12 modules (A to L) about several topics of primary importance for the project (see Appendix 2 for questionnaire).

- Module A aims to collect information about the respondent and household characteristics.
- Module B aims to collect information about household livelihoods, such as main sources of livelihoods and income, main products that provide livelihoods and income for the household, total production per year, and land tenure.
- Module C aims to identify what are the drivers of change that are impacting farmers' livelihoods.

[8] Power calculations were also performed for alternative number of clusters. The smallest MDES is achieved when the greatest amount of clusters is considered.

- Module D focuses on the impacts of climate change, to understand how different hazards, such as strong winds, droughts, hail, frost and flood, may impact households' activities and assets and the food security of household members.
- Module E identifies the actions that farmers are taking to address the impacts of climate change on their livelihoods, assets and food security.
- Module F aims to collect information to measure the food security in the household, following the World Food Program guidelines (see section 5e).
- Module G collects information to understand the climate awareness of farmers, and whether they have received climate information through various channels.
- Module H aims to collect information on forest degradation and deforestation.
- Module I aims to collect information on the types of markets that farmers sell the products to, and whether they are conducting activities to improve the value of their products.
- The last part of the questionnaire aims to collect information on farmers' assets and inputs.

Households to be interviewed were randomly selected within the population eligible to the program in sample VOI and Fokontany. The respondents of the household survey were male and female decision-makers in the households. The respondents were those self-identified as the primary member responsible for decision making in the household, for both social and economic decisions mainly related to agriculture and income. During the pilot survey it was found that interviewing the woman and man together during the survey could provide more precise information regarding the household. Therefore, it was decided that men and women would be interviewed together unless there was only one decision-maker in the household.

The questionnaire was administrated in face to face interviews in the respondent's home using paper forms. At the beginning at the interview, respondents were asked to provide an oral consent for the interview. The data collection team also asked for their consent to take a picture and record the GPS coordinate of their house. The team also clarified that all the information provided was going to be coded so that their names would be kept confidential and only few CI staff would be able to get that information (i.e. the Chief of Party and two staff responsible for M&E, according to the data management plan).

d. Training and data collection

For conducting the household survey in the selected villages in CAZ and COFAV, 24 enumerators and 8 chief enumerators were hired by CI for two months (mid-February to mid-April 2019). A training manual was developed by CI Madagascar team in Malagasy, and enumerators and chief enumerators were trained during two parallel training sessions in Toamasina and Fianarantsoa, from 12th February 2019 to 21st February 2019 by eight CI Madagascar staff (4 for CAZ, and 4 for COFAV) accompanied by a representative of C4ED for COFAV. The training was divided in two parts: four days of training indoors, and seven days of training application in the field and data collection.

During the indoor training, the enumerators and chief enumerators received information about activities and goals of the GCF project and the household data collection. They also received the questionnaire in paper form and the lists of households that need to be interviewed. The enumerators and chief enumerators also interviewed each other to familiarize themselves with the questionnaire and had the opportunity to provide suggestions to improve it. The questionnaire was then updated to incorporate those feedbacks.

CI team also provided a training on how to select randomly the households to interview using computer or phone. Indeed, for one of the comparison group and some of the VOIs, a complete list of households could not have been obtained before going to the field. As a result, the data collection team had to get an appointment with the chief of Fokontany/Chief VOI to get the members list[9] and then to perform the randomized selection of households to interview. Individuals not part of a VOI and who work in the tertiary sector were excluded from the sample (e.g. communal employee or secretary).

During the week of practice in the field, CI staff trained and supervised the enumerators and chief enumerators on how to conduct the interviews and on how to introduce the project with the selected communes, fokontany, and VOI presidents. In addition, CI staff introduced the methodology on the drafted itineraries[10] of each group of enumerators during the field survey and how to identify the location of the households. As the target communities were widespread in COFAV and CAZ, CI needed to divide the enumerators for CAZ and COFAV in groups. In general, each of the group were composed by a chief enumerator and four enumerators. The roles and responsibilities of enumerators, chief enumerators and CI staff were also presented. During this week, the enumerators were also asked to do the first data collection trial, in one VOI for COFAV and a comparison group for CAZ (82 households in total). The datasheets were then verified by the chief enumerators with the support of CI staff. The chief enumerators ensured that all questions were filled in correctly, using the appropriate code, and that there were no questions missed. They also ensured that the name of the household was the same as in the database. If not, that would require an explanation from the enumerator (e.g. the name was different because it was the head of the households that figured in the membership list of the VOI, but only his wife was present). The chief enumerators got familiar with the database to be used to compile all the information collected during the household survey and received copies of the household database and report templates.

Data collection took a total of three months to be completed. The first interviews in the training sites began in February 16th, 2019, and the last interview was done in May 15th 2019, in CAZ. CI Regional staff went from time to time in the field to join the enumerators and chief enumerators during their data collection itineraries. They jointly discussed progress and challenges and met with the VOI chief or the fokontany. Overall, data was collected on 2730 households. Their locations are illustrated by Figures 11 and 12. Due to security reasons, we replaced the VOI in COFAV, "Lovasoa Tsy Miala", by a nearby VOI, Ambohibalo Miray VOI randomly selected by C4ED.

[9] List members if VOI for phases 1 and 3 were collected in December 2018.

[10] Following the list of VOI to be visited in COFAV and CAZ, and as CI knows well the location of the VOIs, we drafted a plan itinerary (with indication of duration from a place to another , e.g. from a fokontany to a village, indicating the number of days suggested to make the interviews in a village) for each group of enumerators that cover all the VOIs to be interviewed. However, the itinerary from a VOI to another was defined only when the enumerators/ chief enumerator arrived in the village.

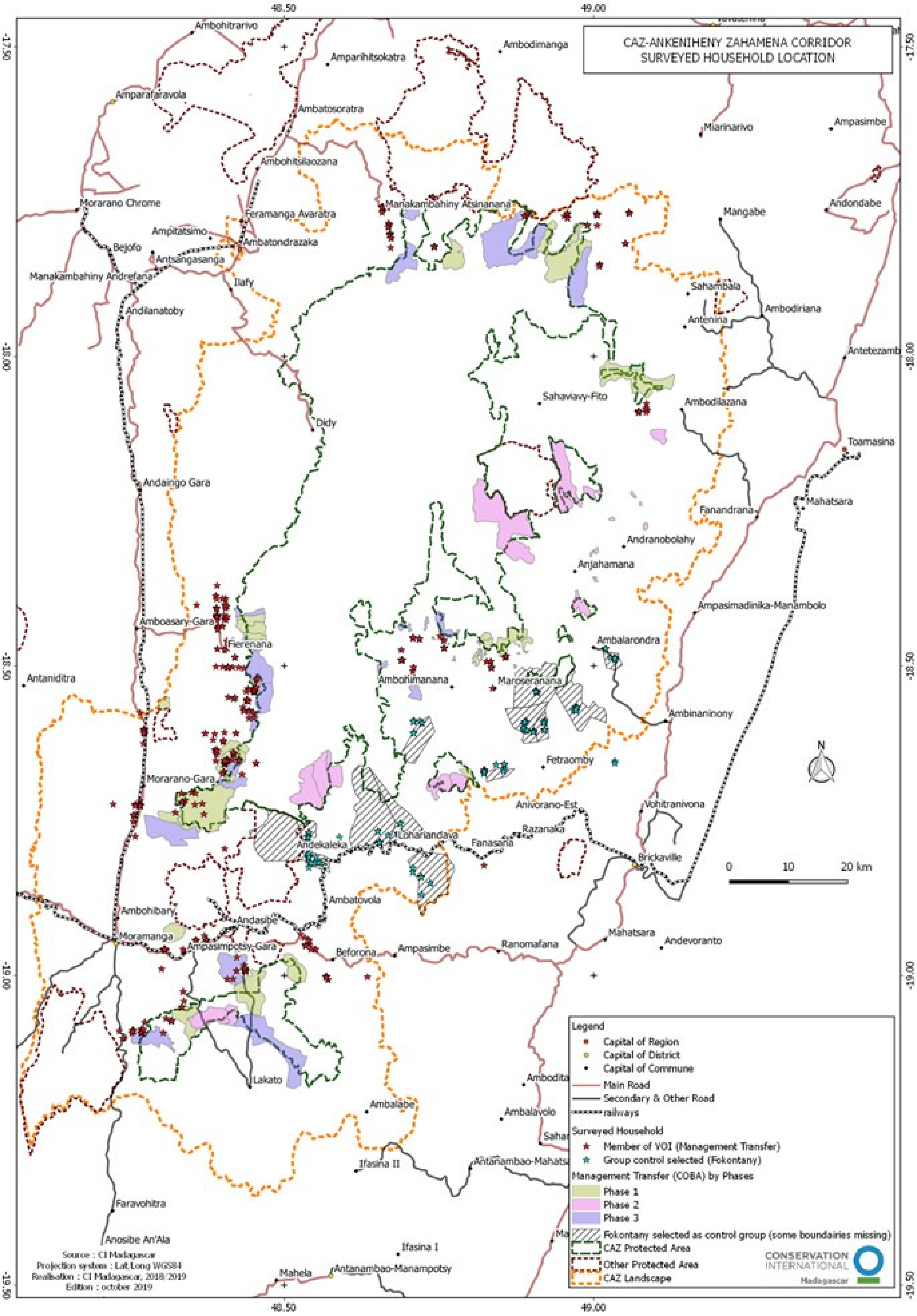


Figure 11 : Map of the treated households and the group control surveyed at CAZ in February -May 2019

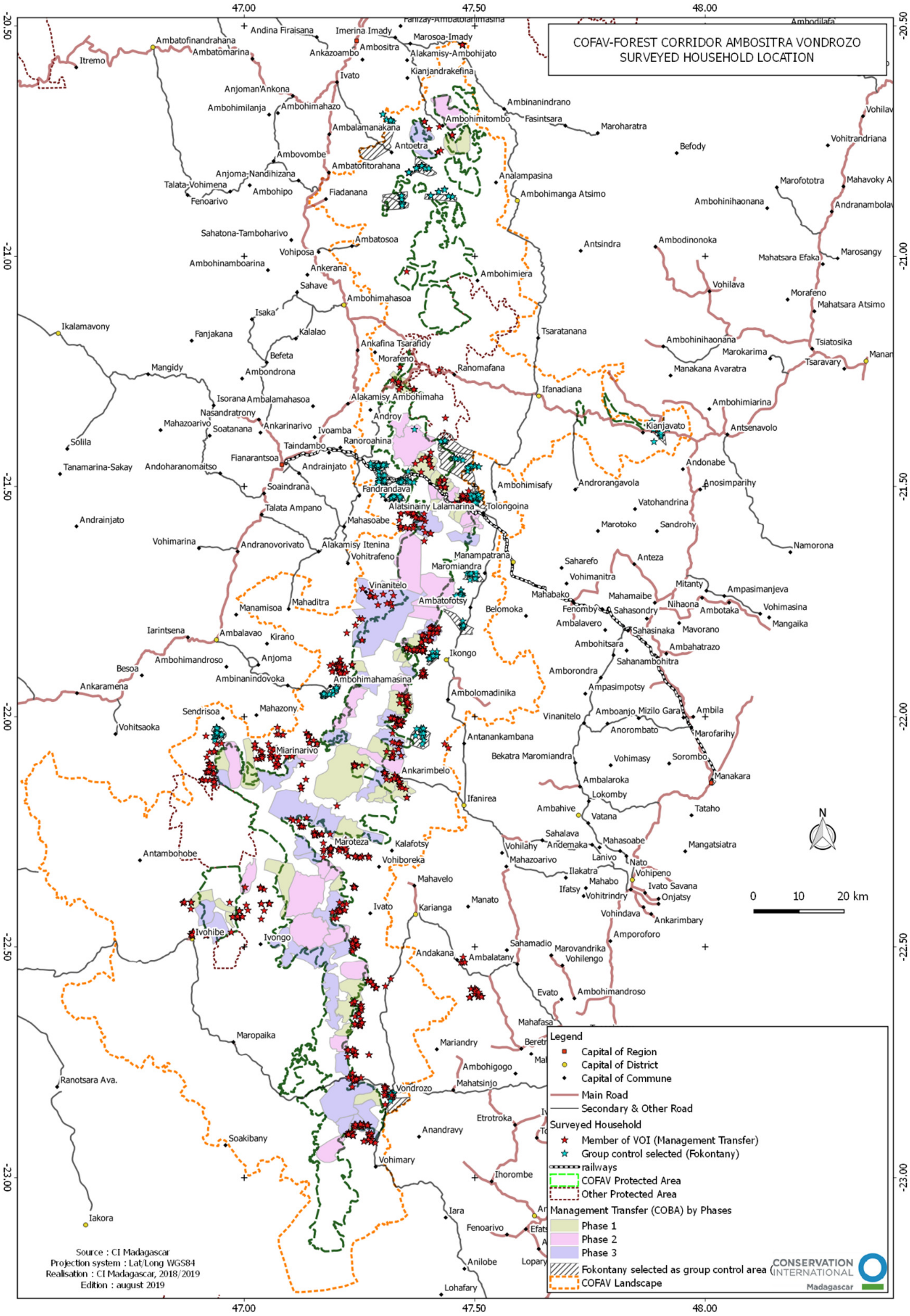


Figure 12 : Map of the treated households and the group control surveyed at COFAV in February -May 2019

e. Data quality assurance

The data quality process followed five levels. The first level was performed directly during the interviews by CI Regional Staff, to ensure that data collection was proceeding smoothly**.** Indeed, some of our CI Regional Staff from CAZ and COFAV went to the field in random place and checked questionnaires randomly. The second level of control was performed by chief enumerators who checked that the questionnaire was fully and accurately filled by the enumerators. In particular, they checked whether there were missing or unclear responses. The chief of enumerators also checked that the respondents' names were reported correctly. In a third level of control, CI Madagascar staff in the field offices verified the accuracy of the data included in the database by comparing it with paper questionnaires. This step was performed by three persons, and by chief enumerators. Another level of control was performed by CI in Antananarivo. M&E staff checked that the coding of Fokontany, commune, region, and households were accurate and also highlighted some irregularities in the responses. A final check was performed by CI staff in Washington DC that checked the consistency of the data by performing summary analysis and cross-checking trends in answers.

f. Final dataset and non-completion rates

Table 3.Number of households interviewed in CAZ and COFAV during the HH survey that took place from February to May 2019

	CAZ	COFAV	Total
Number of Households in VOI	732	1090	1822
Number of Household surveyed in Comparison groups	362	546	908
TOTAL	1094	1636	2730

Table 4. Number of households interviewed in CAZ and COFAV by phase

	CAZ	COFAV	Total
Phase 1	406	560	966
Phase 3	326	530	846
TOTAL	732	1090	1822

Some households initially sampled for the household survey could not be interviewed and were replaced to reach the targeted sample size.[11] Sampling weights have been computed to account for differences in the size of VOI and fokontany selected to be part of the evaluation sample.

g. Climate change Vulnerability Index

To assess the climate change vulnerability of the target population, CI developed a climate change vulnerability index that builds on data collected in the household survey. As there is no standardized way to measure climate change vulnerability, CI identified the variables from the household survey that best assess the 3 components used to assess the vulnerability to climate change: exposure, sensitivity and adaptive capacity.

Exposure of the target population refers to changes in climate or weather (e.g. rainfall changes, temperature changes, changes in sea level, increased incidence of hurricanes and droughts, etc.) that are affecting/will affect the region where the target population lives.

Sensitivity of the target population refers to the impacts that changes in climate or weather cause on the livelihoods of the target population (e.g. by affecting crop production) and/or on the ecosystem services that they rely on (i.e. water, wild food, pest control, ecotourism).

Adaptive capacity of the target population refers to whether they can adjust to the changes in climate and weather and its impacts. Capabilities include human, social, financial, physical, and natural capital, institutions and entitlements, knowledge and information, decision-making and governance.

CI developed composite indices for each one of those components, which were computed based on the questions collected during the baseline. CI then aggregated these 'sub-indices' into a final climate change vulnerability index for each household. Questions marked with an asterisk below will be repeated after project interventions are implemented, such that the comparison of the vulnerability index, as well as of the sensitivity and adaptive capacity before (baseline) and after (endline) project implementation can be done.

Despite the wide variety of methods for assigning variable weights, they ultimately become value judgments. Equal weighting is usually selected either because it is believed that the indicators are all equally important or because there is no agreed upon alternative weighting scheme. For the present analysis, CI proceeded with an equal weighting approach.

1. Calculation of the Exposure score

The following variables, assessed through specific questions asked during the household survey, were used to calculate the exposure of each household. All variables were categorized in quartiles and then

[11] Some household heads were in the field to do gold mining or working in a place located far from their home, some household heads were at the hospital, the name of the household head was not accurate, the household head had moved to another place, the household representative was dead, or the household head name was not recognized in the hamlet.

ranked from 1-4 (1= low exposure, 4=high exposure). The exposure component is the average of the ranked variables 1-3. In all cases, a higher number will represent higher exposure.

- Variable 2: Question 28.1 Number of times the household was impacted in the last five years: sum of the number of times that the household was impacted by different climate hazards
- Variable 3. Question 28.3 Severity of hazards: number of latest events with raking 1 (severe)

2. Calculation of the Sensitivity score

The following variables, assessed through specific questions asked during the household survey, were used to calculate the sensitivity of each household. All variables were categorized in quartiles and then ranked from 1-4 (1=low sensitivity, 4= high sensitivity). The sensitivity index is the average of the ranked variables 4-6. In all cases, a higher number will represent higher sensitivity.

- Variable 4*: Question 29. House and assets damaged: sum of the scores
- Variable 5*: Question 29. Percentage of decrease in harvest/production/ animals' dead: average of the percentage across products.
- Variable 6*. Question 29: Sum of the days when transportation was un-operational, days without school, days injured/sick and days of recreational activities lost.

3. Calculation of the Adaptive capacity score

The following variables, assessed through specific questions asked during the household survey, were used to calculate the adaptive capacity of each household. All variables were categorized in quartiles and then ranked from 1 to 4 (1= high adaptive capacity, 4= low adaptive capacity). The adaptive capacity index is the average of the ranked variables 7-21. In all cases, a higher number will represent higher adaptive capacity but for the calculation of the vulnerability index, the ranking will be inverted, as lower adaptive capacity leads to higher vulnerability).

- Variable 7*: Question 12. Household member: Ratio total adults/total members.
- Variable 8: Question 14. Highest Education level of the HH head: code as is in the survey.
- Variable 9: Question 15. Ability to read: code as is in the survey.
- Variable 10*: Question 19. Household physical characteristics: sum of codes.
- Variable 11*: Question 20. House facilities: sum of codes.
- Variable 12*: Question 21. Source of livelihood: code as in the survey.
- Variable 13*: Question 23: Number of crops, livestock and forest products used.
- Variable 14*: Question 24. Total production of crops, livestock and forest products: (selling+storage)/total production.
- Variable 15*: Question 25. Access to own land: ratio (total owned/total).
- Variable 16*: Question 33, 35, 37: Total number of Responses implemented.
- Variable 17*: Question 33, 35, 37. Conservation agriculture/ EbA responses implemented: total number of practices implemented.
- Variable 18*: Question 42. Access to and use of weather forecast services: sum of codes for sub-questions 1, 3 and 4.

- Variable 19*. Question 56. Access to and use of information on markets: sum of codes for sub-questions 1,3 and 4.
- Variable 20*: Question 57. Membership: Sum of code numbers.
- Variable 21: Question 58: sum of code numbers.

4. Calculation of the climate change vulnerability index

The final vulnerability index of each household was calculated as the average of the exposure, sensitivity and adaptive capacity scores. The vulnerability index ranges from 1, indicating a marginally vulnerable household, to 4, indicating and extremely vulnerable household, as illustrated by Table 5. CI calculated the vulnerability index for each household, then computed the average index for each landscape (CAZ and COFAV), for each gender of the head of household (Male and Female), for each association type (VOI and outside), and for households assigned to each implementation phase (phase 1 and phase 3).

h. Food Security Index

For assessing the food security of the households, we followed a method used by the World Food Programme (WFP). The WFP developed a standardized approach for assessing and reporting on household food insecurity in 2012. The Consolidated Approach for Reporting Indicators of Food Security (CARI) helps to develop food security indicators in a quantitative, systematic and transparent way. In the CARI method, three food security indicators commonly used by WFP are combined into a summary indicator, called the Food Security Index (FSI). The Food Security Index represents the *overall food security status* of the population of interest (e.g. household, village, region). The household is the smallest unit of analysis in the CARI. Each individual household is categorized into a food security group from 1-4 (i.e. 1) Food secure 2) Marginally food secure 3) Moderately food insecure 4) Severely food insecure). This index has been used by WFP to track progress and effectiveness of food-related operations and in the scientific literature [12]. In addition, a scientific comparative study that compared different food security indexes recommended the use of the WFP methodology when planning interventions related to long-term chronic food insecurity [13].

Based on the answers to the household's questionnaire's module on Food security, CI calculated the three sub-indexes that combined formed the CARI Food Security Index (see Table 6). The three sub-indexes are the Food Consumption Score, the Food Expenditure Share, and the livelihood coping strategies categories.

[12] Isaura et *al.* 2018 (Isaura, E., Chen, Y.C. and Yang, S.H., 2018. The association of food consumption scores, body shape index, and hypertension in a seven-year follow-up among indonesian adults: A longitudinal study. *International journal of environmental research and public health*, *15*(1), p.175).

1. Food Consumption Score

The **food consumption score** is an indicator on dietary consumption that includes both quantity and quality considerations. The quantity part of the indicator is calculated using the frequency of consumption (number of days) of eight food groups consumed by a household during the thirty days before the survey. The quality part of the indictor is calculated using the dietary diversity of the household that is assessed through the number of different food groups consumed over the last thirty days.

2. Food share of expenditure

The food share of expenditure helps estimate how much of the household budget is used for food. In other words, how big is the role of food with respect to the consumption of other non-food items. The index is based on food expenditure shares, with the most food insecure spending greater than 75% of their budget on food and food secure spending less than 50%.

3. Livelihood coping strategy

The livelihood coping strategy categories are used to assess how the households meet their basic food needs despite being affected by shocks. It is used to understand the frequency and severity of changes in food consumption of households that are affected by shortage of food. Understanding the household's strategies to adapt to recent impact of climate change provides insights into the difficulty of their situation, and how likely they will be to meet challenges in the future. The interviewed households were asked if any member in their households had to engage in 10 coping strategies because there was not enough food or money to buy food during the past 30 days. Households were asked about four stress strategies, three crisis strategies, and three emergency strategies that were categorized according to the severity of the strategies. The 10 strategies were selected following the CARI methodology and based on known strategies used in the region form previous household surveys. The higher the value of the index, the higher the degree of food insecurity.

4. Calculation of the food security index

Following the CARI methodology, the food security index is calculated using the averages of the three sub-indexes with more weight to the food consumption compared to the food expenditure and coping strategies (Food Security Index= AVERAGE(Food Consumption, AVERAGE(Food Expenditure, Food Coping Strategies))). CI calculated the food security index for each household, then computed the average index for each landscape (CAZ and COFAV), for each gender of the head of household (Male and Female), for each association type (VOI and comparison group), and for households assigned to each implementation phase (phase 1 and phase 3).

Table 5. Overview of the four categories in the CARI Food Security Index (1-4) that combine three sub-indexes of Food Consumption, Food Expenditure and Coping Strategies.

		Food Secure (1)	Marginally Food Secure (2)	Moderately Insecure (3)	Severely Insecure (4)
Food Security Household Description		Able to meet essential food and non-food needs without depletion of assets.	Has minimally adequate food consumption, but unable to afford some essential non-food expenditures without depletion of assets	Has food consumption gaps, OR, Marginally able to meet minimum food needs only with accelerated depletion of livelihood assets.	Has large food consumption gaps, OR, Has extreme loss of livelihood assets that will lead to large food consumption gaps, OR worse.
Current Status	Food consumption score	Acceptable	-	Borderline	Poor
Coping Capacity	Food Expenditure Share	< 50%	50% -- 65%	65% -- 75%	≥ 75%
	Livelihood coping strategy categories	No asset depletion	Stress Strategies (e.g. sell non-prod assets)	Crisis Strategies (e.g. sell prod assets)	Emergency Strategies (e.g. sell major prod assets – land)
TOTAL FOOD INSECURIRTY INDEX		**% HH**	**% HH**	**% HH**	**% HH**

i. Analysis methodology

Descriptive statistics involve summarizing and organizing the data so they can be easily understood. It seeks to describe the data, but do not attempt to make inferences from the sample to the whole population.

As all the members of our target population in CAZ and COFAV did not have the same probability to be in the sample, we needed to adjust for these differences by calculating the weight of each observation. These weights were then included in the descriptive analysis in order to make our results representative of the target population.[14] For continuous variables (e.g. age, distance), we needed to make a weighted calculation of average, standard deviation, and median. For binary or categorical variables, we computed weighted percentages. All calculations were performed using the Excel software.

1. Sampling weights

Sampling weights were calculated for each VOI and each Fokontany Control (fkt control) as followes:

$$Weight\ of\ sampling\ for\ VOI1 = 1/\left(\frac{N\ total\ of\ hh\ in\ VOI1\ surveyed}{N\ total\ of\ hh\ in\ VOI1}\right)$$

$$Weight\ of\ fkt\ control\ 1 = 1/\left(\frac{N\ total\ \ of\ hh\ \ in\ fkt\ control\ surveyed}{N\ total\ of\ hh\ in\ a\ fkt\ control}\right)$$

2. Weighted Mean / Average

Mean or Average is a central tendency of the data i.e. a number around which a whole data is spread out. In a way, it is a single number which can estimate the value of whole data set. For our case, we used weighted average calculations. The weighted average formula is as follows:

$$Weighted\ mean = \frac{\sum_{i=1}^{n}(xi * wi)}{\sum_{i=1}^{n} wi}$$

Where n is the size of the sample, xi is the value of interest for the observation i, wi is the weight associated to this observation.

3. Weighted percentage

The following formula was used to compute weighted percentages:

[14] The target population is made of households eligible to the program in the project's intervention area, and of households whose main activity is based on agriculture, herding or the use of natural resources for areas outside of the project's intervention area.

$$Weighted\ percentage = \left(\frac{\sum_j^m wj}{\sum_i^n wi}\right)$$

Where m is the number of observations in the category of interest j (e.g. number of woman), wj is the weight of the observation j, n is size of population of interest (e.g. number of woman+ number of men) and wi is the weight associated to the observation i.

4. Weighted Median

Median is the value which divides the data in two equal parts, i.e. the number of terms on the right side of it is similar than thenumber of terms on the left side of it when data is arranged in either ascending or descending order. This value was computed directly in the Excel software using VBA (Visual Basic Application).

5. Measure of Spread / dispersion: weighted standard deviation

Standard deviation is the measurement of average distance between each quantity and the mean. That is, how data is spread out from the mean. A low standard deviation indicates that the data points tend to be close to the mean of the data set, while a high standard deviation indicates that the data points are spread out over a wider range of values.

$$Weighted\ standard\ deviation = \sqrt{\frac{\sum_{i=1}^N wi(xi - x*)^2}{\frac{(M-1)}{M}\sum_{i=1}^N wi}}$$

N is size of the sample, wi weight of the observation i, xi is value of interest for individual i, x* average weighted mean, M is the number of weights different than 0.

6. Student test or test t

Student test is used to compare two independent groups. We used SPSS and STATA to perform this test and also STATA software, including sampling weights and clustering standard errors at the VOI level when comparing characteristics between VOI members and at the Fokontany level when comparing characteristics between VOI members and members of the outside comparison group.

V. Baseline Study Survey Results

The baseline study survey results are presented in the following part of this report. We present the results following each module in the questionnaire. Information was summarized and presented through graphs and tables accompanied by comments on these results. All calculations include sampling weights, as described in the section "Analysis methodology".

Module A: Households characteristics

In this module, the households interviewed were asked about their general demographic characteristics and about the places where they live.

a. Household distances from Fokontany center and closets forest

The table 6 below shows that the household average distance to the Fokontany center and the nearest forests is around one (1) hour in CAZ and COFAV.

Table 6. Average weighted walking distance of from a household's home to the Fokontany center and to the nearest forest (min)

	CAZ	**COFAV**	**Total**
N	732	1088	1820
Household walking distance from Household to Fokontany center (min) ±SD[15]	50 ± 38	50± 27	50± 30
Median value distance from household to Fokontany center (min)	*(60)*	*(60)*	*(60)*
Household walking distance to nearest forest (min) ±SD	56 ± 26	65± 23	62± 24
Median value distance to from household to Fokontany center (min)	*(60)*	*(60)*	*(60)*

[15] SD: Standard deviation

b. Head of household

Most of the households in CAZ and COFAV are man-led. A family, "household", or in Malagasy "*ankohonanana*" is defined here as the people that are living under the same roof and using the same stove. A household head is the one that makes decisions in the household. Men take decisions in the households according to 87% of the respondents in CAZ and 86% in COFAV. Around 8% of the households are headed by a widowed or a single woman in COFAV and CAZ. Only 1% and 2 % of households, respectively for CAZ and COFAV, are led by a woman because the man is not there to take decision (see Table 7).

Table 7. Head of households in CAZ and COFAV

	CAZ	COFAV	Total
N	732	1088	1820
Man headed HH with wife/s	87%	86%	86%
Man headed HH with no wife/ widowed	5%	4%	4%
Woman headed HH widowed / no husband	8%	8%	8%
Woman headed HH, husband not there take decision	1%	2%	2%

c. Ethnicity

The Madagascar population comes from multiple ethnicities that are also present in the project sites (Figure 13. COFAV has a higher diversity of ethnic groups (10) compared to CAZ (8). The main three dominant groups in CAZ are: the Betsimisaraka group (53%), the Bezanozano group (26%), and the Merina (12%). In COFAV, these groups are different, with the main group being the Tanala Group (36%), followed by the Betsileo Group (35%) and by the Sahafatra group (8%).

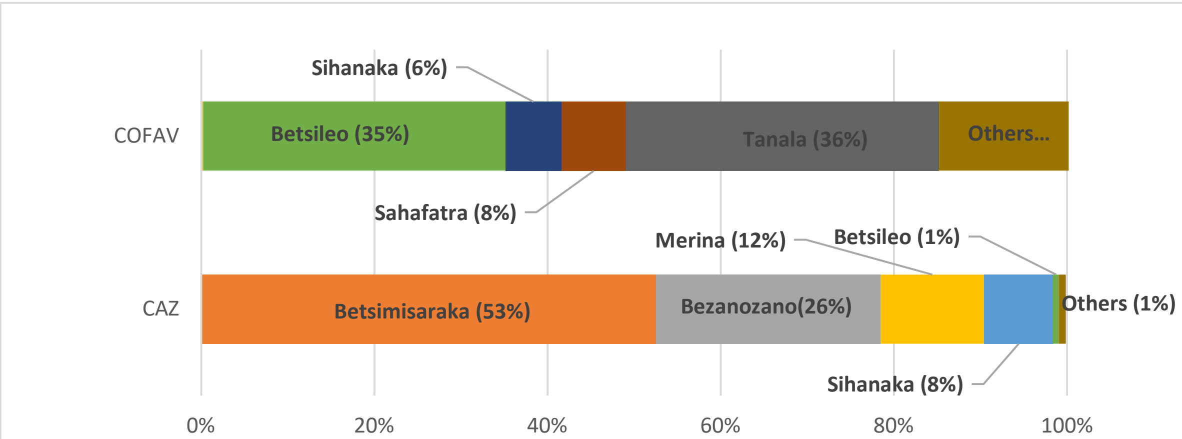


Figure 13: Ethnic groups in CAZ and COFAV, within local communities (Ntotal =1822, NCAZ=732; NCOFAV= 1090)

d. Respondent's year of birth

The age distribution is similar in both project sites (Figure 14). The youngest individual surveyed was 16 years old, whereas the eldest was 95. Two people interviewed do not know their exact year of birth, which is common in some of the most rural villages.

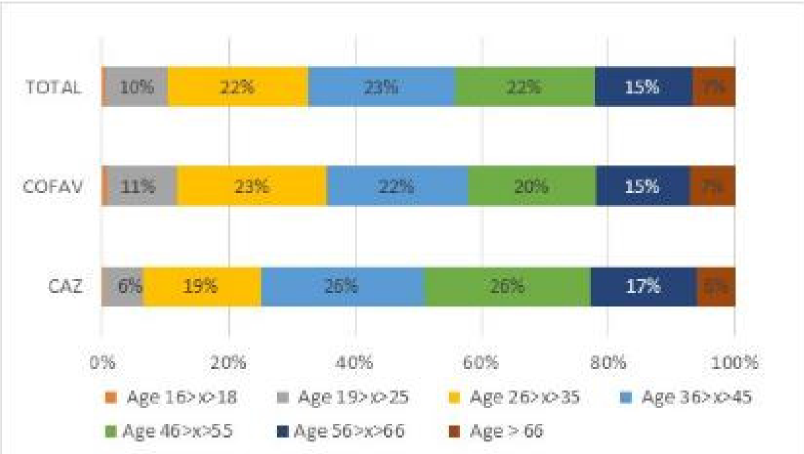
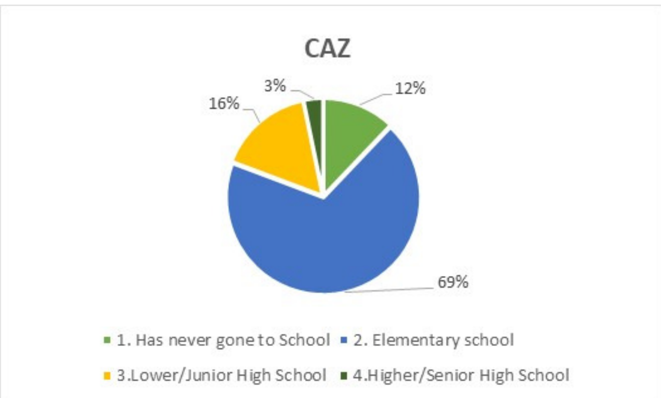


Figure 14: Age of respondents in CAZ and COFAV

(N total =1820; N CAZ= 732; N COFAV=1088)

e. Respondent's highest education level completed

A significant number of respondents only reached the level of elementary school, completed or not, with a percentage being slightly higher in CAZ (66 % for COFAV and 69% for CAZ). Respectively 12% and 15% of the respondents in CAZ and COFAV have never attended school. Only few respondents (3% CAZ, and 4% for COFAV), were able to get technical trainings and attend higher school, in CAZ and COFAV sites (Figure 16).



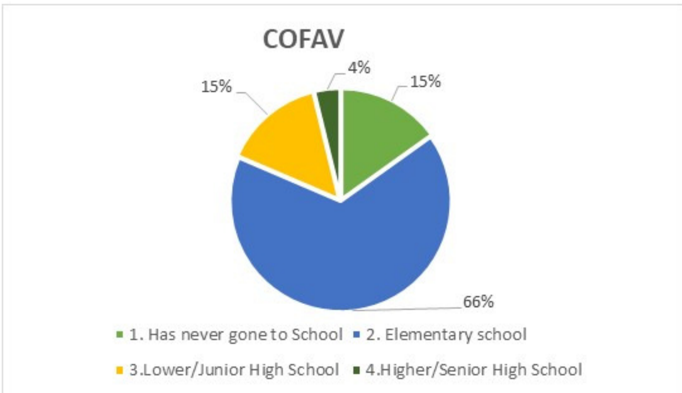
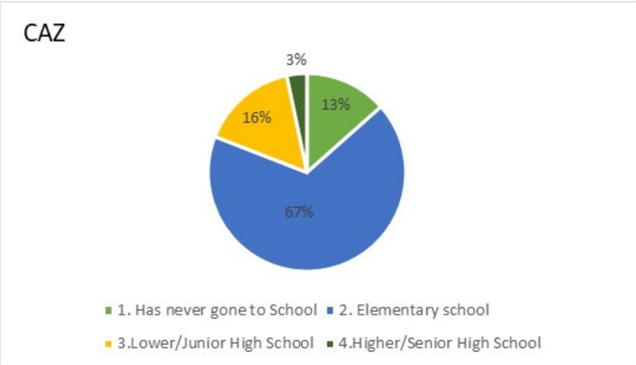


Figure 15 : Respondent's education level in CAZ and COFAV, within local communities (N total= 1822, N CAZ= 732; N COFAV=1090)

f. Head of household's highest education level completed

The trend is almost similar to that of the respondent's education level described above. The difference between the percentage of individuals that never went to school between CAZ and COFAV is larger among household heads than among respondents (13% and 19% respectively, see Figure 16).



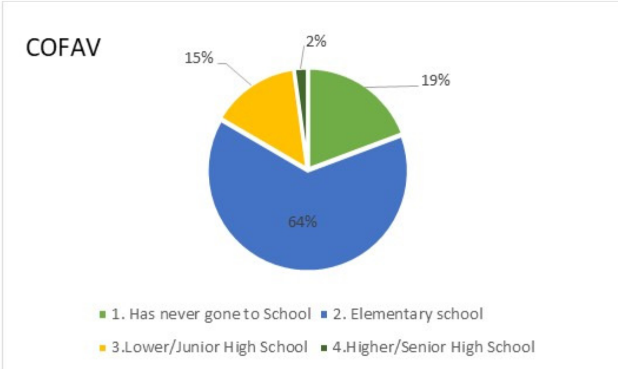


Figure 16 : Head of household's education level in CAZ and COFAV, within local communities (N total= 1818, N CAZ= 732; N COFAV=1086)

g. Household size in CAZ and COFAV local communities

The average household size is six (6) in both CAZ and COFAV (see Table 8).

Table 8. Household size in CAZ and COFAV Local Communities

	CAZ	**COFAV**	**Total**
N	732	1089	1821
Average number of individuals in a Household ±SD	6±1	6±1	6±1
Median number of individuals in a household	(7)	(6)	(6)

h. Children's schooling

The rate of school non-attendance differs slightly between children in CAZ and COFAV. 43% of the households with children from 6 to 12 years old in CAZ, and 41% in COFAV, reported that none of their children goes to school (see Table 9).

Table 9. Percentage of households having children between 6 and 12 years old going and not going to school

	CAZ	COFAV	Total
N	732	1088	1820
Household having all children not going to school	43%	41%	42%
Household having one or more children going to school	57%	59%	58%

i. Respondent's literacy in Malagasy, French or other languages

Around one quarter of the respondents were not able to read Malagasy or other languages (see Figure 17), this percentage being higher in COFAV. Around 55% of the respondents in CAZ and 62 % in COFAV stated that they can read in Malagasy. Around 15% of respondents in CAZ and 16 % in COFAV said they can read in Malagasy and French. Only about 1% of the respondents in both CAZ and COFAV can read in other languages in addition to Malagasy, such as Italian or Latin.

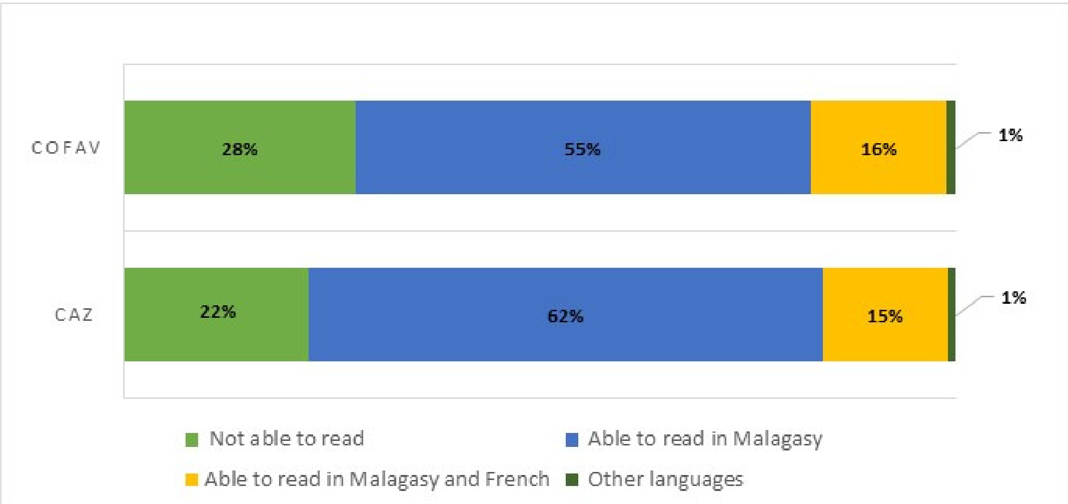


Figure 17: Ability of respondents to read in Malagasy, French, or other languages (N Total= 1822, N CAZ= 732; N COFAV=1090)

j. House ownership in CAZ and COFAV

Almost all respondents own their house, this percentage being higher in CAZ (97% against 93% in COFAV, see Figure 17). Few of them are living for free, i.e. they borrowed houses that belong to their families or friends (5.3% for CAZ and 2.5% for COFAV). Only about 1% of the respondents are renting the house that they live in. In few other cases, the house belonged to the state, to the society or an institution for which the respondent works (e.g. teachers house) (see Figure 18).

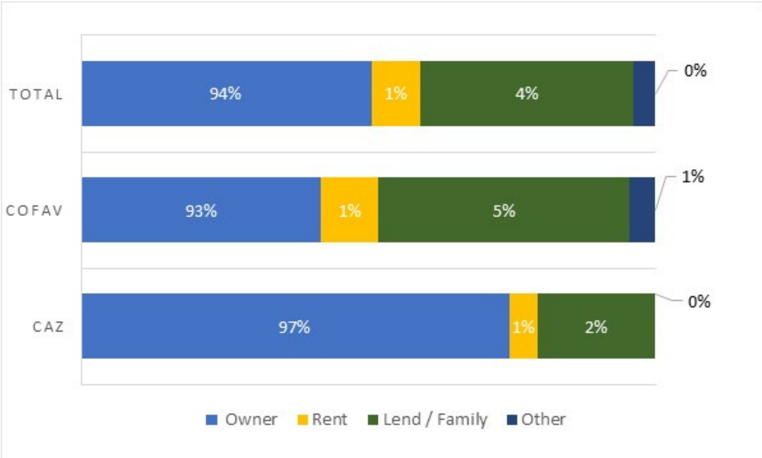


Figure 18: Households' house ownership in CAZ and COFAV

(N Total= 1822, N CAZ= 732; N COFAV=1090)

On average, respondents in CAZ and COFAV have lived in the village for around 16 years (see Table 10), with less than one third residing in the village for less than 5 years (Figure 19). Only a few people migrated to the village the last 12 months (1%) (see Figure 19).

Table 10. Number of year of residence in a village

	CAZ	**COFAV**	**Total**
N	732	1088	1820
Average numbers of year of residence of a Household in a village) ±SD	15 ± 7	17 ± 6	16 ± 6
Median number of year of residence of Household in a village	(23)	(30)	(26)

Figure 19: Number of years that respondents are living in the same village (N Total= 1820, N CAZ= 732; N COFAV=1088)

k. Respondent's last place of residence Reason for moving to the current village of residence

Most of the respondents (63% in CAZ and 50% in COFAV) (see Table 11) have been always living in the place they currently are. However, in CAZ there is some internal relocations within the village (32% of household respondents moved within the same village, compared with 13% of the respondent in COFAV).

About 11% of the respondents in both CAZ and COFAV have moved within the same municipality. Other respondents have moved within the region, 7% for of respondents in CAZ and 1 % in COFAV, whereas 5% of respondents for in CAZ and 6% for COFAV have moved in from other regions.

Table 11. Last place of residence

Category	**CAZ**	**COFAV**	**TOTAL**
N	731	1083	1814
Same place	63%	50%	53%
Same village	13%	32%	27%
Same municipality	11%	11%	11%
Same Region	7%	1%	7%
Outside the Region	5%	6%	2%

l. Reason for moving to the current village of residence

44% of the respondents in CAZ and 52 % in COFAV reported that they moved due to family reasons. However, insufficient land is also an important reason for moving, especially in CAZ (24% in CAZ and 13 % in COFAV) (see Figure 20). Work opportunities seem to be another important reason for moving, especially in COFAV (28% in COFAV and 22% in CAZ). Climate-related reason account for 1-5% of the reason for moving. Other reasons to move include insecurity, social conflicts, agricultural reason, and impact of cataclysms on their house.

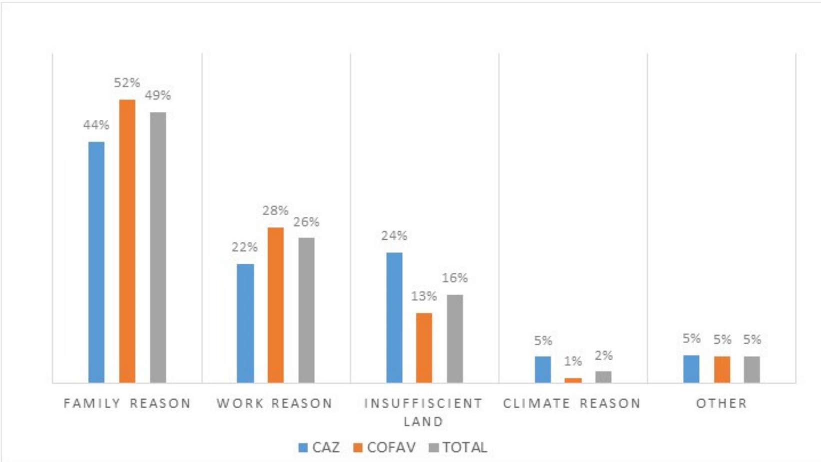


Figure 20: Reasons from moving from their previous place to their current house (N Total= 585, N CAZ= 343; N COFAV=585)

m. Dwelling characteristics

Through observations of the enumerator and confirmation from the respondents, houses in CAZ and COFAV are mostly made of basic materials. Roofs are mostly made with cheap natural products for 53 % of households in CAZ (with leaves or grass), and 60% of households in COFAV. The walls of most of the households are also made of cheap natural products in both CAZ (58 % of households) and COFAV (70%). The average number of rooms per house is equal to two for both CAZ and COFAV (see Table 13).

Table 12. House characteristics of respondents in CAZ and COFAV

	Category	CAZ	COFAV	TOTAL
	N	731	1083	1814
Roof	Cheap natural products	53%	60%	58%
	More expensive local products	10%	8%	9%
	Products sold in another place and expensive	37%	31%	33%
Wall	Cheap natural products	32%	31%	31%
	Local products more expensive	61%	64%	63%
	Products sold in another place and expensive	7%	6%	6%
Floor	Cheap natural products	5%	70%	66%
	Local products more expensive	22 %	16%	18%
	Products sold in another place and expensive	20%	14%	16%
	N	731	1083	1814
Room	Number of rooms	2 ± 1	2 ±1	2 ±1
	Median (number of rooms)	(2)	(2)	(2)

Most people interviewed in COFAV and CAZ do not have access to electricity, respectively 58% and 77% of households. However, they use generator or solar panel, respectively for 41% and 21% in CAZ and COFAV. The solar panel are generally used in for lamps and charging mobile phone, whereas the battery is used for lamps. Only 1% of the respondents interviewed in CAZ and COFAV said that they have access to a paid connection electrical grid (see Table 13).

Table 13. Household facilities in CAZ and COFAV: electricity, water and toilet

	Category	CAZ	COFAV	TOTAL
	N	731	1083	1814
Electricity	No access to electricity network;	58%	77%	71%
	Unpaid connection to grid or through village system;	-	1%	1%
	Paid connection to electrical grid	1%	1%	1%
	Use of own generator or solar panel	41%	21%	27%
Water	Stream, river, pond;	75%	66%	69%
	Common faucet or well, or neighbor's faucet or well, or common rain-fed reservoir;	21%	31%	28%
	Own well or own rain-fed reservoir;	3%	-	1%
	Piped water from groundwater beneath house;	-	2%	1%
	Piped water from municipal system or water company	-	1%	1%
Toilets	Do not have toilets	9%	39%	30%
	Stream, river, pond, open air, neighbor's faucet or well, or common rain-fed reservoir	5%	5%	5%
	Shared latrine with pit or floating over water (not flushed with water)	40%	26%	30%
	Own latrine with pit or floating over water (not flushed with water	46%	30%	35%

Most households interviewed got water from streams, rivers or ponds. Only 21% of interviewed households in CAZ and 31 % in COFAV get water from common faucet or wells, or from a common rain-fed reservoir. A few people get water from other sources. Only 1 % of respondents in both CAZ and COFAV get water from their own well or own rain-fed reservoir, or from piped water from municipal system or water company.

A big difference between households in CAZ and COFAV is whether they have toilets. Households in CAZ seems to have toilets more than COFAV households. Nine percent of the households interviewed in CAZ do not have toilets compared to 39% of households in COFAV. 40% of households in CAZ and 26% in COFAV shared latrine with their family or neighborhoods. 46% of households in CAZ and 30% in COFAV have their own latrine with pit or floating over water. Few households (5%) for CAZ and COFAV said that they use stream, river, pond, open air or neighbor's faucet as toilets instead.

The main reasons households do not have toilet in CAZ is because their toilet is out of use (47%) and for COFAV, because they are not interested in having one (52%). 13% of respondents in CAZ and 7% in COFAV said that they were not used to have one. Other reasons for not having a toilet include cultural, material and logistical (no place, no money) motives, use of common toilet, water concern (land with a lot of water that made the construction of toilets difficult, or existing water but at a low level that is not suitable for having toilets) (see Figure 21).

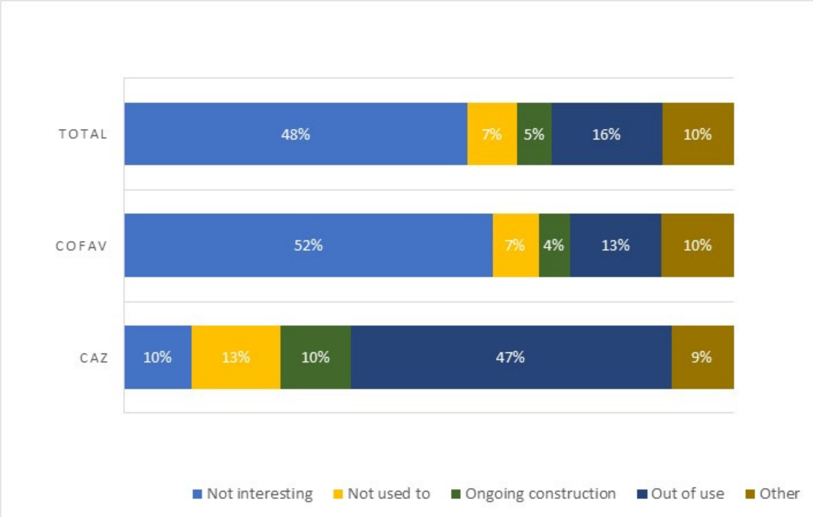


Figure 21: Reason for not having toilets in the household. Data analysed: those who responded that they do not have toilet (N Total= 501, N CAZ= 70; N COFAV=431)

n. Source of fuel for cooking

Table 14 shows that the first main material used by households to cook is firewood in 96.9% of the households in CAZ and 98.1% in COFAV, followed by charcoal.

Table 14. Materials available in Households for cooking

	Category	**CAZ**	**COFAV**	**TOTAL**
	N	731	1083	1814
Cooking type number 1	Fuel wood	97%	99%	98%
Cooking type number 2	Charcoal	3%	1%	2%

Module B: Main economic activities of households

In this module, we asked the respondents about their livelihood's activities and their relative importance.

a. Main sources of livelihood/ income of households during the wet season and dry season

The primary source of livelihood or income is here defined as an activity that takes more than 95% of their time. Agriculture is the primary activity during both the wet season and the dry season for communities in both CAZ and COFAV (see Table 15 and Table 16).

The secondary activity practiced by communities in CAZ and COFAV during both the wet season and in dry season, when relevant, is herding.

The most common tertiary activity, when existent, practiced during the wet season is collecting forest product. About 17% of the households have a tertiary activity in dry season, which includes gold mining, handcrafting, daily work, charcoal, alcohol production, and job occupation such as agent of the community, teacher, patroller, carrier[16] and little seller.

Table 15. Main activities during wet season

	CAZ		COFAV		Total	
	Primary activity	**Secondary activity**	**Primary activity**	**Secondary activity**	**Primary activity**	**Secondary activity**
N	732	732	1090	1090	1822	1822
Agriculture	95%	4%	97%	2%	96%	2%
Livestock	-	79%	-	76%	-	76%
Fisheries	-	1%	-	-	-	-
Forest products				-	-	-
collection	-	1%	-			
				12%	3%	12%
Others	4%	9%	2%			
No activity	1%	6%	-	10%	1%	10%

[16] A person paid daily to carry heavy luggages, materials…

Table 16. Main activities during dry season

	CAZ		COFAV		Total	
	Primary activity	Secondary activity	Primary activity	Secondary activity	Primary activity	Secondary activity
N	732	732	1090	1089	1822	1822
Agriculture	94%	5%	95%	1%	95%	2%
Herding	-	78%	-	74%	-	75%
Fisheries	-	1%	-	1%	-	1%
Forest products collection	-	1%	-		-	1%
Others	5%	9%	4%	10%	4%	10%
No activity	1%	6%	1%	13%	1%	11%

b. Three most important crops, animals or forest products for household's livelihood

Rice is considered the most important crop for livelihood of households in CAZ (95%) and COFAV (86%). Cassava is considered the second most important crop for livelihoods and food security of households in CAZ (55%) and COFAV (62%). Sweet potato is the third most important crop for livelihood and food security in CAZ (23%) and COFAV (20%) (see Table 17).

Table 17. Most important crops for livelihood/food security in CAZ and COFAV communities

	CAZ			**COFAV**			**Total**		
	Top1	**Top2**	**Top 3**	**Top1**	**Top2**	**Top 3**	**Top1**	**Top2**	**Top 3**
N	734	734	734	1088	1088	1088	1822	1822	1822
Rice	95%	1%	1%	86%	9%	2%	88%	7%	2%
Cassava	2%	55%	20%	10%	62%	9%	8%	60%	12%
Corn	-	4%	16%	-	9%	7%	-	8%	9%
Banana	1%	9%	13%	-	2%	18%	1%	4%	17%
Bean	-	21%	14%	1%	5%	7%	1%	9%	9%
Sugar Cane	-	-	1%	-	1%	5%	-	1%	4%
Sweet potatoes	-	2%	20%	1%	7%	23%	-	6%	23%
Peanuts	-	1%	4%	-	-	2%	-	-	2%
Tarot	-	-	1%	-	1%	5%	-	1%	4%
Ginger	1%	1%	-	-	1%	1%	-	1%	1%
Pineapple	-	-	1%	-	-	-	-	-	-
Other	-	3%	2%	1%	1%	1%	-	1%	1%
Not applicable	1%	1%	6%	1%	2%	19%	1%	2%	16%

Cattle raising is important for the households in COFAV (40% of households) but less for communities in CAZ (24% of households), where chicken is considered the most important animal for their livelihood (52% of Households). Forty-four percent of the households in CAZ and COFAV do not have a secondary livestock/domestic animal activity, and 78% of respondents in CAZ and 68% in COFAV do not have a tertiary livestock/domestic animal activity (see Table 18).

Table 18. Most important livestock/ domestic animal activities for livelihood/food security in CAZ and COFAV communities

	CAZ			**COFAV**			**Total**		
	Top1	**Top2**	**Top 3**	**Top1**	**Top2**	**Top 3**	**Top1**	**Top2**	**Top 3**
N	734	734	734	1088	1088	1088	1822	1822	1822
Cow	24%	3%	1%	**40%**	3%	1%	36%	3%	1%
Goat	-	-	-	-	-	-	-	-	-
Sheep	-	-	-	-	-	-	-	-	-
Pig	7%	7%	2%	12%	21%	4%	11%	18%	3%
Chicken	**52%**	**22%**	**6%**	35%	**31%**	**17%**	39%	28%	14%
Duck	2%	9%	6%	1%	3%	4%	1%	5%	4%
Aquaculture fish	1%	1%	1%	-	-	1%	-	1%	1%
Goose	2%	8%	3%	-	1%	1%	1%	2%	1%
Dokotra	-	3%	2%	-	3%	6%	-	3%	5%
Barbarie Duck	-	-	-	-	-	0%	-	-	-
Turkey	-	1%	-	-	1%	1%	-	1%	1%
Rabbit	-	1%	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-
Not applicable	12%	44%	78%	10%	44%	65%	11%	44%	68%

Forest products seem to be important as crops and livestock for livelihood of households in CAZ and COFAV. The main forest products collected are firewood and wood for house building (see Table 19). However Coffee seems to be more important in COFAV compared with CAZ (21 % in COFAV and 7 % for CAZ said that it is important as top 1 forest product), and firewood seems more important for CAZ compared with COFAV (74% of responses for top 1 in CAZ and 30 % for top 1 in COFAV)

Table 19: Most important forest products for livelihood/food security in CAZ and COFAV communities

	CAZ		**COFAV**		**Total**	
	Top1	**Top2**	**Top1**	**Top2**	**Top1**	**Top2**
N	734	734	1088	1088	1822	1822
Wood for house building	13%	19%	13%	9%	13%	12%
Firewood	74%	14%	30%	18%	40%	17%
Leaves for animal feeding	-	-	-	-	-	-
Leaves for handcraft	-	- 1%	1%	1%	1%	1%
Coffee	7%	- 2%	21%	4%	18%	4%
Clove	1%	3%	0%	0%	1%	1%
Fruits	-	3%	1%	2%	1%	2%
Roots	-	1%	0%	1%	0%	1%
Wild animals	-	-	-	-	-	-
Honey	1%	2%	2%	0%	2%	1%
Guinea Fool	-	-	-	-	-	-
Charcoal	2%	4%	-	-	1%	1%
Other	-	1%	2%	1%	1%	1%
Not applicable	2%	50%	28%	50%	22%	50%

c. Rice production, consumption, and storage

On average, CAZ households reported that they produce more rice (967 kg during the last 12 months) compared with COFAV households (670 kg) (see Figure 22).

Figure 22 shows that the rice produced in households in both CAZ and COFAV is mainly for their own consumption, and not for selling or storage. About 2/3 of the production is for own consumption in CAZ and about 2/5 in COFAV. Only 1/3 of the rice produced by the household is sold in CAZ and 1/5 in COFAV. Low amounts of rice produced by the household is stored.

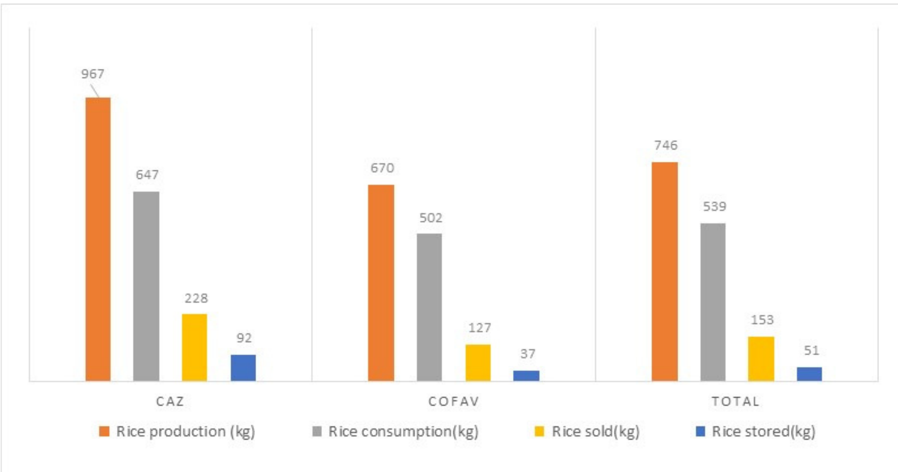


Figure 22: Rice production, consumption, and storage in CAZ and COFAV in the last twelve months (N Total= 1579, N CAZ= 689; N COFAV=890)

d. Cassava production, consumption, and storage

On average, cassava is produced in higher quantity per household in COFAV (1493 kg) than in CAZ (515 kg). Cassava is cultivated essentially for own consumption in both CAZ and COFAV and only a few people stored it (see Figure 23).

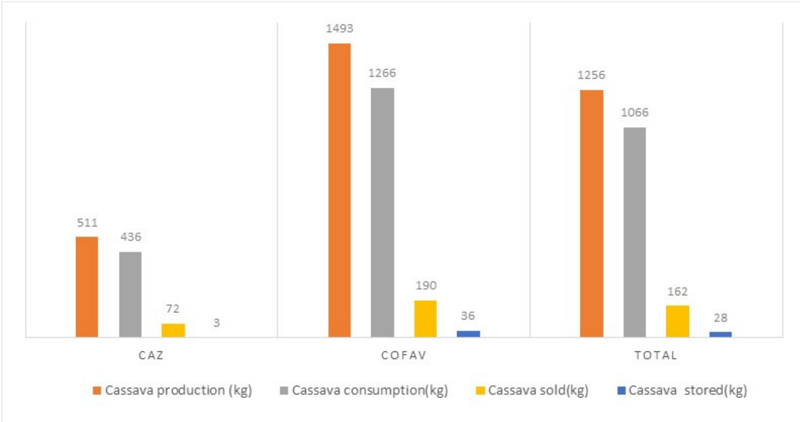


Figure 23: Cassava Production, consumption and storage in CAZ and COFAV in the last 12 months (N Total= 1083, N CAZ=397; N COFAV=686)

e. Cattle herding, selling, consumption and keeping

Average cattle raised per household were six (6) in CAZ and COFAV in the past 12 months (see Figure 24). Note that in these areas cows are usually not produced for meat consumption but are produced to be sold or just stored .

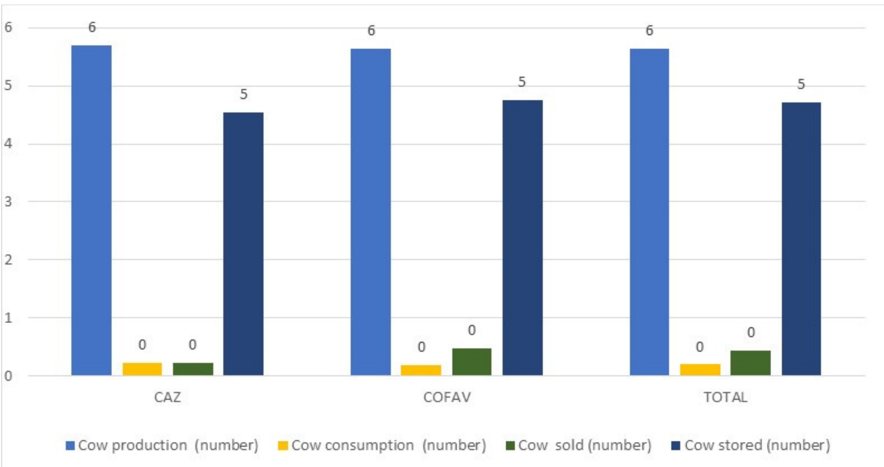


Figure 24: Cow production consumption, and storage in CAZ and COFAV in the last 12 months

(N Total= 1083, N CAZ=397; N COFAV=686)

f. Chicken production, selling, consumption and keeping

The number of chickens per household on average is 24 in CAZ and 19 in COFAV. Households in CAZ eat on average 5 of the chicken raised per year and households in COFAV eat 6 chicken per year. On average, 9 chickens are kept throughout the year in CAZ and 7 in COFAV (see Figure 25). More chicken on average died due to diseases in CAZ (5) compared to COFAV (2).

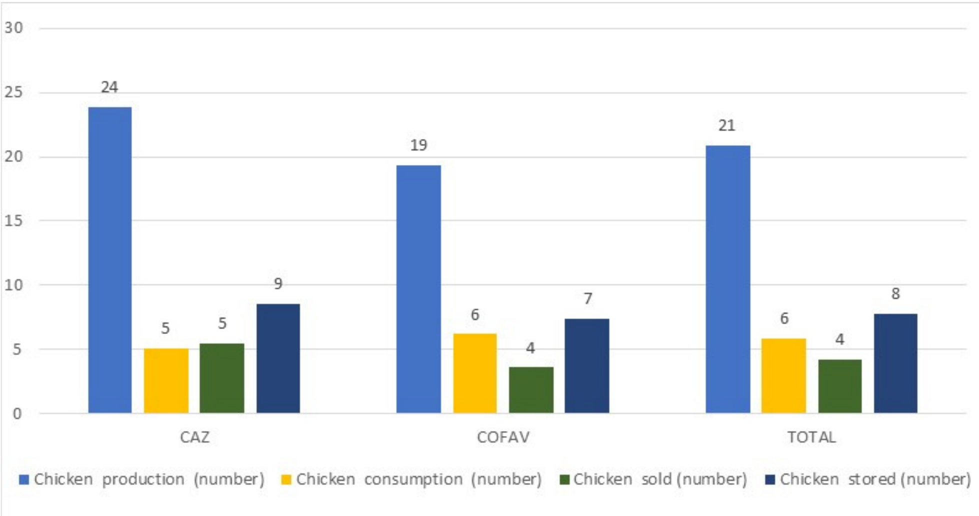


Figure 25: Chicken production, consumption, and storage in CAZ and COFAV in the last 12 months (N Total= 1083, N CAZ=397; N COFAV=686)

g. Land ownership

On average, the size of the land used by households is 5 hectares in CAZ and 3 hectares in COFAV. Our data shows that, on average, most of the land is owned by the respondents. Land ownership is defined here as land that is owned by the households through traditional customs or legal title. Traditionally, property is transferred through generations and does not mean that household own a legal title. Table 20 shows land size in CAZ and COFAV classified as owned, communal and owned by the state

Table 20.Surface area used by households

Category	CAZ	COFAV	TOTAL
N	732	1090	1822
Surface area owned (ha) ±SD	3 ± 3	2 ± 3	3 ± 3
Median value(ha)	(2)	(2)	(2)
Surface area rented (ha) ±SD	0 ± 0	0 ± 0	0 ± 0.
Median value(ha)	(0)	(0)	(0)
Surface area communal (ha) ±SD	1 ± 6	1 ± 4	1± 4
Median value(ha)	(0)	(0)	(0)
Surface area land state owned (ha) ±SD	1± 1	0 ±0	0 ± 0
Median value(ha)	(0)	(0)	(0)

h. Perception of overall food production and food security compare with one year ago (2017)

Most of the households in COFAV (44 %) stated that this year overall production was better than the previous year. However, in CAZ, a similar percentage of respondents (41%) said that their production was better compared to those that said that the production was worst compared to the previous year. Fewer respondents stated that production was like the previous year (CAZ: 17%, COFAV: 16%) (see Figure 26).

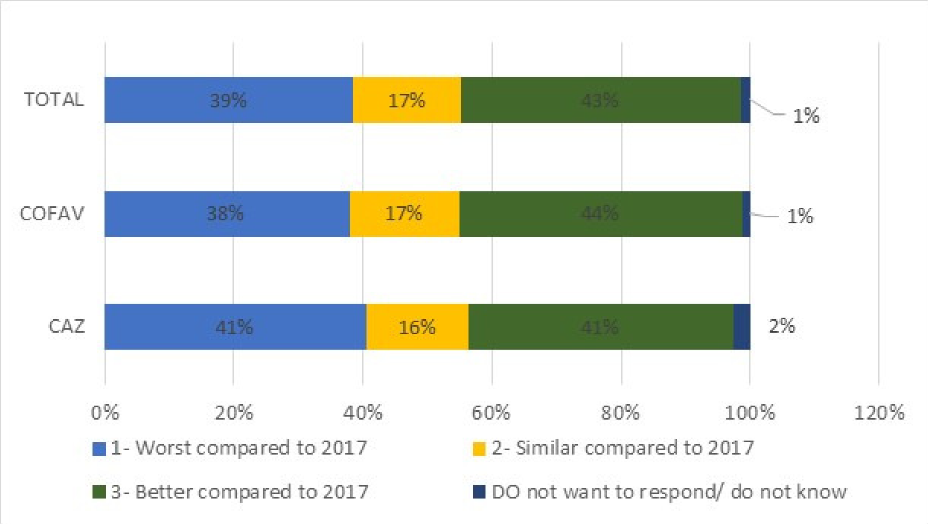


Figure 26: Perception of production in 2018, compared to 2017, for households in CAZ and COFAV

(N Total=1822 , N CAZ=732 ; N COFAV=1090

Module C: Drivers of change in households

This module is exploring changes experienced by households in CAZ and COFAV in 2018 that had consequences on their livelihoods.

a. Changes that lead to negative impacts on livelihood/ food security

Changes experienced by CAZ and COFAV households were classified and linked to the following categories: market, climate, land production, labor, disease or pests. In the domain of market, the main changes experienced by households in the past 12 months (from the date of interview) that had a great impact on livelihoods were the difficulties to have access to agricultural inputs (CAZ: 74 %, COFAV: 71 % of respondent asked). Regarding climate change, most of households in CAZ and COFAV experienced more unpredictable rainfall in the past 12 months (CAZ: 83 %, COFAV: 80 %). Regarding land production, most households in CAZ and COFAV highlighted that land was less productive in the past 12 months (CAZ: 76 %, COFAV: 60 % of respondent asked), compared to less productive land available. Regarding labor, around 50% of households in CAZ and 71% in COFAV mentioned that they were unable to hire workers due to high costs, which has negatively impacted household's livelihood. The majority of households in CAZ and COFAV experienced more agriculture pests and diseases (CAZ: 92%, COFAV: 89 % of respondent asked), as well as more human diseases (74% in CAZ and 50% in COFAV), in contrast to less pest and diseases, that have negatively impacted household's livelihood (see Table 21).

Table 21: Changes experienced by households in CAZ and COFAV during twelve months prior to the survey that lead to negative impacts on livelihood/ food security

		CAZ	COFAV	Total
	N	732	1090	1822
Market/ State	Low price to sell agricultural products	31%	19%	22%
	Low demand for agricultural products	36%	41%	40%
	Difficult access to agricultural inputs	**74%**	**71%**	**72%**
	Low market accessibility (roads, …)	59%	49%	51%
	More restrictive rules for land use/products	19%	11%	13%
Climate	More unpredictable rainfall (later/earlier start)	83%	80%	81%

	Less overall rainfall/more frequent droughts	61%	52%	54%
	More intense drought	66%	54%	57%
	More overall rainfall/more frequent floods	48%	57%	55%
	More intense floods	63%	52%	55%
	More frequent winds/STRONG WINDs	52%	51%	52%
	More intense winds/STRONG WINDs	65%	59%	60%
	Higher temperatures	71%	43%	50%
	More frequent/intense hail	48%	32%	36%
	More frequent/intense frost	20%	29%	27%
Land	Land is less productive	76%	60%	64%
	Less productive land available	58%	49%	51%
Labor	Unable to hire labor because it is too expensive	55%	71%	67%
	Unable to hire labor because it is not available	10%	16%	14%
Pest/ Diseases	More agriculture pests/diseases	92%	89%	90%
	New agriculture pests/diseases	63%	47%	50%
	More human diseases	74%	50%	56%

b. Frequency of disasters for Households the last five years

We investigated how often households were impacted by the following climate hazards in the last five years (2013-2108): cyclone, drought, flood, hail and frost. We asked also the latest year when each of these types of extreme weather events occurred and ask them to estimate the severity of each type of hazards (from 1- lowest severity to 3-highest severity).

1. Cyclone

On average, strong winds affected a household twice (N_{total}= 1819, N_{CAZ}= 730, N_{COFAV}= 1089) during these last five years. According to the respondents, the last event occurred in 2015 for CAZ, and in 2017 for COFAV. The severity of those cyclone events was classified as of low severity.

2. Drought

In average, drought affected a household twice (N_{total}= 1819, N_{CAZ}= 732, N_{COFAV}= 1087) during the last five years. According to households interviewed, the last year that such event occurred was in 2017 for both CAZ and COFAV. This event was considered of mild and high severity for CAZ and COFAV, respectively

3. Flood

On average, floods affected a household twice (N_{total}= 1819, N_{CAZ}= 732, N_{COFAV}= 1087) from 2013 to 2018. According to the respondents, last year when it occurred was in 2018, for COFAV and CAZ. Respondents classified those events of mild severity.

4. Hail

On average, hail affected the households once in the last five years for both CAZ and COFAV (N_{total}= 1822, N_{CAZ}= 732, N_{COFAV}= 1090). Respondents said the year that it last occurred was in 2018. Those events were classified as of low intensity in CAZ and of the mild intensity in COFAV.

5. Frost

On average, frost occur three time the last five years (N_{total}= 501, N_{CAZ}= 370, N_{COFAV}= 131). The latest occurred in 2018 for CAZ and COFAV, with mild severity.

Module D: Climate change impacts

The aim of this module is to identify the impacts of climate hazards on households' house, materials and assets, transportation, crops, animals, forest products, human health, school attendance, and participation in social events in the community.

a. Impact on house

Around 60% of households in CAZ and COFAV told that cyclone events did not have any damage on their house. Likewise, most of the respondents said that drought, hail, frost and flood did not have any impacts on their house. A low percentage of respondents (15% in both CAZ and COFAV) reported small damages in the roof from cyclone events (see Table 22).

Table 22: Impact of Climate change on households' house in CAZ and COFAV in 2018

		CAZ	COFAV	Total
	N	732	1088	1822
Cyclones	No damage	56%	67%	64%
	Few damage (only the roof)	15%	15%	15%
	Wall damage	11%	7%	8%
	Roof and Wall	12%	7%	8%
	Severely damaged	7%	5%	5%
Drought	No damage	100%	100%	100%
Hail	No damage	97%	98%	98%
	Few damage (only the roof)	3%	2%	2%
Frost	No damage	100%	100%	100%
Flood	No damage	97%	97%	97%
	Few damage (only the roof)	-	1%	1%
	Wall damage	1%	1%	1%
	Roof and Wall	1%	1%	1%
	Severely damaged	1%	-	-

b. Impact on assets and materials

Table 23 shows that most of the respondents said that climate hazards did not have impacts on assets and materials. However, cyclones led to some severe damages in 13 % of households in CAZ and in 2% of households in COFAV.

Table 23: Impact of extreme climate on assets and materials experienced by Households in CAZ and COFAV in 2018

		CAZ	COFAV	Total
	N	732	1090	1822
Cyclones	No damage	82%	92%	90%
	Few damage	2%	3%	3%
	Mid damage	3%	3%	3%
	Severely damaged	13%	2%	4%
Drought	No damage	100%	100%	100%
Hail	No damage	98%	99%	99%
	Mid damage	1%	-	-
	Severely damaged	1%	-	-
Frost	No damage	100%	100%	100%
Flood	No damage	95%	100%	97%
	Few damage	1%	-	1%
	Mid damage	1%	-	1%
	Severely damaged	3%	-	1%

c. Impact on road accessibility

Climate hazards have impacts on road accessibility for almost all households. Respondents said that, due to the cyclones, roads were not accessible during an average number of three (3) days during the last 12 months for both COFAV and CAZ. Nevertheless, 50 % of respondents reported that cyclone affected road accessibility for one to two days only during the last 12 months. Regarding floods, roads were not accessible during an average of two (2) days (see Table 24).

Table 24: Average number of days roads were not accessible during the year the cataclysm occurred

	CAZ	COFAV	TOTAL
N	731	1090	1821
Number of days road was not accessible due to Cyclone ±SD	3 ± 3	3 ± 5	3 ± 4
Median value (number of days)	*(1)*	*(1)*	*(1)*
Number of days road was not accessible due to Flood ±SD	2 ± 3	2 ± 5	3 ± 4
Median value (number of days)	*(0)*	*(0)*	*(0)*

d. Impact on top 1 crop production

Climate hazards have impacts on top 1 crop production. In total, if we combine cyclone, hail, drought, frost, flood, according to respondents, 55% of the production was lost for both COFAV and CAZ because of climate hazards.

Cyclone seems to have the highest effect on top 1 crop with 22 % of the production lost for CAZ and 24 % for COFAV, followed by flood in second position with 10% of the production lost for CAZ and 14 % for COFAV, and in third position by drought with 18 % and 10% of the production lost for CAZ and COFAV respectively.

Frost and hail have a low effect compared with the climate hazards mentioned above (Table 25).

Table 25: Percentage of production loss for top 1 crops

	CAZ	COFAV	TOTAL
N	731	1090	1821
Percentage of production loss for crop top 1 due to cyclone ±SD	22 ± 16	24 ± 10	23 ± 11
Median value (percentage)	*(10)*	*(20)*	*(20)*
Percentage of production loss for crop top 1 due to drought ±SD	18 ± 16	10 ± 8	12 ± 11
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 1 due to hail ±SD	4 ± 7	4 ± 6	4 ±6
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 1 due to frost ±SD	1 ± 3	1 ± 2	1 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 1 due to flood ±SD	10 ± 12	14 ± 8	13 ± 11
Median value (percentage)	*(0)*	*(0)*	*(0)*

e. Impact on top 2 crop production

Climate hazards have an effect on production loss for top 2 crops, essentially consisting of cassava. In total, if we combine the value of loss due to cyclone, drought, hail, frost and floods, we reach 33 % of the production lost for CAZ and 29% for COFAV. However, cyclone is associated with 20% of the production lost for CAZ and 16 % for COFAV, and this is the climate hazard that led to the largest loss in production for top 2 crops (Table 26).

Table 26. Percentage of production loss for top 2 crops

	CAZ	COFAV	TOTAL
N	731	1090	1821
Percentage of production loss for crop top 2 due to cyclone ±SD	20 ± 16	16 ± 9	17 ± 11
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 2 due to drought ±SD	7± 12	3 ± 5	4 ± 7
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 2 due to hail ±SD	2 ± 7	3 ± 5	3 ± 6
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 2 due to frost ±SD	0 ± 2	1 ± 2	1 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 2 due to flood ±SD	4 ± 9	6 ± 6	6 ± 7
Median value (percentage)	*(0)*	*(0)*	*(0)*

f. Impact on top 3 crop production

Climate hazards influence on production loss for top 3 crops, essentially consisting of sweet potatoes and yam. In total, if we combine the shares of production lost due to cyclone, drought, hail, frost and floods, we have 28 % of the production lost for CAZ and 30 % for COFAV. However, cyclone is linked with 17 % of the production lost for CAZ and 11 % for COFAV, and this is the climate hazard that that led to the largest loss in production for top 3 crops (Table 27).

Table 27: Percentage of production loss for top 3 crops

	CAZ	COFAV	TOTAL
N	731	1090	1821
Percentage of production loss for crop top 3 due to cyclone ±SD	17 ± 15	11± 9	13 ± 11
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 3 due to drought ±SD	5± 11	2 ± 4	3 ± 6
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 3 due to hail ±SD	2 ± 5	2 ± 4	2 ± 4
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 3 due to frost ±SD	0 ± 2	1 ± 2	1 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for crop top 3 due to flood ±SD	4 ± 9	4 ± 6	4 ± 6
Median value (percentage)	*(0)*	*(0)*	*(0)*

g. Impact on top 1 animal production

A small percentage (5%) of animal production is affected by climate hazards for CAZ and COFAV (Table 28).

Table 28. Percentage of production loss for top 1 animals

	CAZ	COFAV	TOTAL
N	731	1089	1820
Percentage of production loss for animal top 1 due to cyclone ±SD	2 ± 6	1± 2	1 ± 4
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for animal top 1 due to drought ±SD	0 ± 1	2 ± 5	2 ± 4
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for animal top 1 due to hail ±SD	0 ± 3	0 ± 1	0 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for animal top 1 due to frost ±SD	0 ± 2	0 ± 1	0 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for animal top 1 due to flood ±SD	1 ± 4	0 ± 1	1 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*

h. Impact on top 1 forest products

On average, forest product is less affected by climate hazards for CAZ and COFAV (14% of loss in production) compared with crops (Table 29).

Table 29: Percentage of production loss for top 1 forest products

	CAZ	COFAV	TOTAL
N	727	1090	1817
Percentage of production loss for forest product top 1 due to cyclone ±SD	5 ± 10	8± 8	7 ± 8
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for forest product top 1 due to drought ±SD	1 ± 3	3 ± 4	2 ± 4
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for forest product top 1 due to hail ±SD	0 ± 1	3 ± 3	1 ± 3
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for forest product top 1 due to frost ±SD	0 ± 2	1 ± 1	0 ± 2
Median value (percentage)	*(0)*	*(0)*	*(0)*
Percentage of production loss for forest product top 1 due to flood ±SD	1 ± 5	0 ± 5	2 ± 5
Median value (percentage)	*(0)*	*(0)*	*(0)*

i. Impact on socio-economic activities

Cyclone and flood affect school attendance for around 3 days. Because roads can be blocked after such extreme weather events, children were not able to attend classes. In 2018, it seems that the climate hazards did not affect much the cultural practices of the community (around 0 day reported). During frost, households in CAZ are more affected than households in COFAV. COFAV communities are more sensitive to households in CAZ when facing cyclone and drought (Table 30).

Table 30: Average number of days households members could not do socio-economic activities due to climate hazards the last 12 months

		CAZ	COFAV	TOTAL
	N	731	1089	1820
Number of days children could not go to school due to	Cyclone ±SD	2 ± 3	3 ± 2	3 ± 2
	Median value	*(0)*	*(0)*	*(0)*
	Flood ±SD	1 ± 1	1± 1	1 ± 1
	Median value	*(0)*	*(0)*	*(0)*
	N	731	1079	1810
Number of days people could not do anything due to disease due to	Cyclone ±SD	0 ± 1	1± 2	1± 2
	Median value	*(0)*	*(0)*	*(0)*
	Drought ±SD	0 ± 1	1± 2	1± 1
	Median value	*(0)*	*(0)*	*(0)*
	Frost ±SD	1± 6	0 ± 0	0 ± 3
	Median value	*(0)*	*(0)*	*(0)*
	N	731	1089	1820
People could not participate to cultural events due to	Cyclone ±SD	0 ± 1	0 ± 1	1 ± 1
	Median value	*(0)*	*(0)*	*(0)*
	Flood ±SD	0 ± 1	1± 1	0 ± 1
	Median value	*(0)*	*(0)*	*(0)*

j. Information on household access to food and water

On average, the number of days that household members could not eat three times per day in the last 12 months is around 14 days for CAZ and COFAV. However, there is a high variability for how long their food security was affected. As such, the median value is equal to 0, which means that 50% of the respondents told that they ate three times a day during the last 12 months.

The average number of days the household could not access clean water in the last 12 months is 14 days for CAZ and 8 days for COFAV. However, there is a high variation in the values in our sampling. The maximum value for this is 360 days and was recorded in CAZ.

The average number of days households could not access water for agriculture is estimated to be 22 days for CAZ and 30 days for COFAV (see Table 31).

Table 31: Number of days households could not eat three times a day, could not access to clean water and could not access to water for agricultural during the last 12 months

	CAZ	COFAV	TOTAL
N	731	1090	1821
Number of days people could not eat three times a day ±SD	14 ± 21	14± 15	14± 17
Median value	*(0)*	*(0)*	*(0)*
N	731	1090	1821
Number of days with no clean water in 2018 ±SD	14 ± 22	8 ± 10	10 ± 13
Median value	*(0)*	*(60)*	*(0)*
N	731	1090	1821
Number of days with no water for agricultural use in 2018 ±SD	22 ± 21	30 ± 15	28 ± 16
Median value	*(0)*	*(14)*	*(4)*

29 % of households in CAZ and COFAV could not eat three times a day , 38% and 26 % of households in CAZ and COFAV could not access to clean water and 43% and 53 % declared that they could not have access to water for agriculture (see Table 32).

Table 32: Percentage of households declaring no day, and one day or more they could not eat three times a day, could not access clean water and could not access water for agricultural during the last 12 months

	CAZ	COFAV	TOTAL
N	731	1090	1821
Percentage of HH declaring no day they could not eat three times a day	71%	71%	71%
Percentage of HH declaring one or more days they could not eat three times a day	29%	29%	29%
N	731	1090	1821
Percentage of HH declaring no day they could not access water for food	62%	74%	71%
Percentage of HH declaring one or more days they could not access water for food	38%	26%	29%
N	731	1090	1821
Percentage of HH declaring no day they could not access water for agricultural use	57%	47%	49%
Percentage of HH declaring one or more days they could not access water for agricultural use	43%	53%	51%

When we examined the data among households who reported one day or more for lack of food, lack of water for food or lack of water for agriculture, we found that on average these households could not eat three times a day for 48 days for CAZ and 47 days for COFAV. The average number of days households could not access water for food is higher in CAZ compared with COFAV (47 days for CAZ, 33 days for COFAV). We have the same trend of days for households not having access to water for agricultural purposes for one or more days (see Table 33).

Table 33: Number of days households could not eat three times a day, could not access to clean water and could not access to water for agricultural during the last 12 months, for households reporting a number equal or superior to one

	CAZ	COFAV	TOTAL
N	211	305	516
Weighted average of one or more days household could not eat three time a day +SD	48 ± 29	47± 16	47±20
N	271	289	560
Weighted average of one or more days household could not access to water for food+ SD	47 ± 37	33 ± 16	34 ± 23
N	314	617	931
Weighted average of one or more days household access to water for agricultural use +SD	51±28	57 ±12	55±17

Module E: Household adaptation strategies

Module E explores what are the main adaptation strategies used by households in CAZ and COFAV to face climate hazards with potential impact on agriculture, livestock, and forest products. In addition, this module collected information about priorities and barriers for adaptation strategies of the households.

k. Agriculture

The use of irrigation systems, agroforestry and tree planting, multi-crop systems, soil conservation, pest management, as well as the improvement or creation of a storage facility, the use of more resistant crops, off-season rice cultivation, terracing, and establishment of saving groups are all climate change adaptation strategies used by the households in CAZ and COFAV.

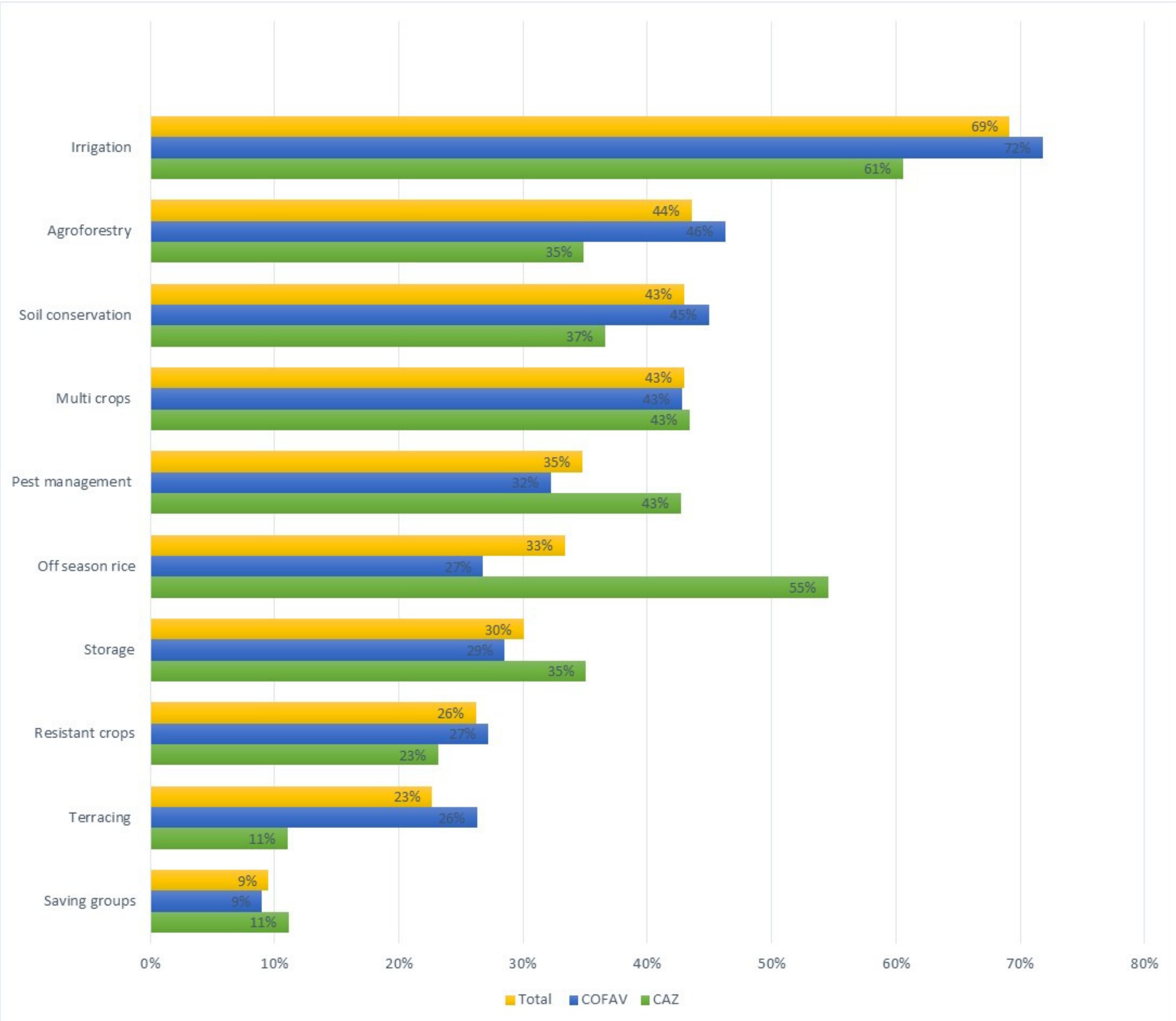


Figure 27. Adaptation strategies used by households facing climate hazards: cultivation

(N Total= 1822, N CAZ=732; N COFAV=1090)

Building or expanding irrigation systems is one of the most common adaptation strategies (61% of the households in CAZ and 72 % in COFAV). Agroforestry and soil conservation measures are also part of the adaptation strategies in CAZ and COFAV and are undertaken by 46% and 45% of the people respectively in COFAV, and 35% and 37% in CAZ. Multi-cropping strategies are used by 43% of respondents in both CAZ and COFAV. Managing pests is also an adaptation strategy for the households in CAZ and COFAV that is conducted by approximatively 43% of the respondents in CAZ and 32 % in COFAV. Using off-season rice is practiced more in CAZ (55%) compared to COFAV (27%). Only 30% of households stored products in CAZ and COFAV, whereas 26% of the households used resistant crops and terracing techniques (23 %). Only few households relied on saving groups as part of their adaptation strategies in CAZ and COFAV (respectively 11 % and 9%) (see Figure 27).

The respondents reported several barriers that hindered the use of certain adaptation strategies to climate-related hazards. The following Table 34 and Table 35 highlight the key barriers or constraints faced by households for specific adaptation strategies in CAZ and COFAV.

For CAZ, the main barriers for households to use strategies for agriculture are lack of knowledge and skills for soil conservation (80% of respondent in CAZ), agroforestry (64% of respondent in CAZ), terracing (79% of respondent in CAZ), resistant crops (55% of respondent in CAZ), and multi-cropping (54% of respondents in CAZ).

However, for irrigation and off-season rice, ‘other barriers’ were listed by respectively 26% and 39% of the respondents. Concerning irrigation, some of the respondents said that they are not doing this practice as watering is sufficient in their area, especially for CAZ respondents. Other households said that they are not doing this practice because they are not cultivating rice in rice fields but growing rice on the ground (“vary an-tanety” in Malagasy), or because of a lack of access to water. Regarding the off-season rice practice, some respondents in CAZ said that the variety of seed rice they are currently using cannot bear cold temperature, or that water availability is the main concern, or that they are used to do “ground rice” cultivation.

For COFAV, the main barrier for households to use strategies for agriculture is a lack of knowledge for soil conservation (44% of the respondents), agroforestry (42% of the respondents), terracing (53 % of the respondents), resistant crops (41 % of the respondents), multi-cropping (37% of the respondents), and irrigation (26% of the respondents).

However, for storage, pest management and saving groups, the main barrier is the lack of money (47%, 53%, 39% respectively). Moreover, some of the respondents said also reported a lack of interest in adopting these strategies (multi-cropping: 39%, saving groups: 28%). For off season rice, the main barrier mentioned is the “other” category (32% of respondents). Many of the respondents said that this practice is not suitable to COFAV, they also mentioned sensitivity of rice to cold, and the non-availability of seeds.

Table 34: Barriers reported by Households who do not use the following adaptation strategies in CAZ for cultivation

	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Soil conservation *(N_{CAZ}= 445)*	23%	80%	-	2%	14%	0%	3%	17%	3%
Agroforestry *(N_{CAZ}= 487)*	4%	64%	-	5%	7%	11%	4%	2%	2%
Terracing *(N_{CAZ}= 636)*	3%	79%	-	-	1%	12%	3%	1%	1%
Resistant crops (N_{CAZ} = 564)	21%	55%	-	-	5%	10%	1%	6%	2%
Multi-cropping *(N_{CAZ}= 420)*	9%	54%	-	4%	4%	20%	3%	3%	2%
Irrigation *(N_{CAZ}= 285)*	10%	22%	-	3%	17%	15%	3%	26%	3%
Off season rice *(N_{CAZ}= 340)*	8%	14%	-	6%	3%	15%	11%	39%	3%

Storage *(N_{CAZ}= 483)*	37%	9%	-	2%	-	23%	5%	17%	5%
Pest management *(N_{CAZ}=406)*	53%	17%	1%	-	3%	8%	1%	13%	3%
Saving groups *(N_{CAZ}=406)*	40%	19%	-	1%	3%	23%	1%	10%	2%

Table 35: Barriers reported by Households who do not use the following adaptation strategies in COFAV for cultivation

	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Soil conservation *(N_{COFAV}= 668)*	19%	44%	-	1%	1%	15%	5%	13%	1%
Agroforestry *(N_{COFAV}= 596)*	5%	42%	-	1%	2%	18%	20%	8%	3%
Terracing *(N_{COFAV}= 828)*	3%	53%	-	4%	6%	21%	6%	4%	3%
Resistant crops *(N_{COFAV}= 832)*	26%	41%	-	1%	3%	16%	2%	10%	2%
Multi-cropping *(N_{COFAV}= 638)*	2%	37%	-	2%	2%	39%	5%	12%	2%
Irrigation *(N_{COFAV}= 313)*	15%	26%	1%	1%	26%	14%	9%	4%	4%
Off season rice *(N_{COFAV}= 801)*	4%	22%	-	2%	4%	25%	7%	32%	4%
Storage *(N_{COFAV}= 798)*	47%	11%	-	-	1%	14%	11%	14%	2%

Pest management *(N_{COFAV}= 754)*	53%	32%	-	-	1%	6%	1%	5%	2%
Saving groups *(N_{COFAV}= 1016)*	39%	11%	1%	-	5%	28%	3%	12%	2%

I. Animals

The enhancement of animal production is defined here as vaccination, using new tools, using chicken housing, or providing additional food to animals. Livelihoods diversification, fish farming, and animal production enhancement are climate change adaptation strategies that have been used in COFAV and CAZ to respond to climate change. However, less than 50% of the respondents are applying those strategies, around 39 % practice livelihoods diversification in CAZ and 31 % in COFAV, whereas animal production enhancement is done by 40% in CAZ and 45 % COFAV, and fish farming is practiced by around 14% of households in CAZ and 16% in COFAV. There is a similar trend for CAZ and COFAV (see Figure 28).

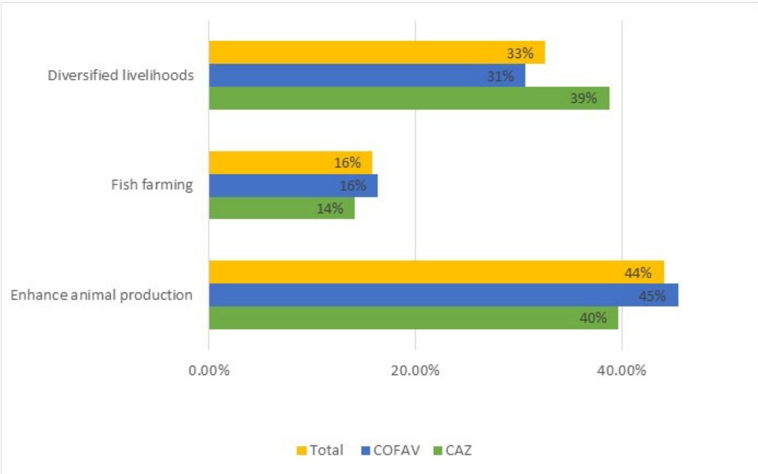


Figure 28: Adaptation strategies used by households facing climate hazards: animals (N Total= 1822, N CAZ=732; N COFAV=1090)

A key barrier for 40% of households in CAZ and COFAV that hinders strategies to enhance of production of **animals** is money. This barrier is followed by limited knowledge and capacity in COFAV. In CAZ, fewer households are interested in doing this strategy compared with COFAV. Enhancement of animal production was not use due to additional other reason, such as cultural practices, lack of disease so no need of vaccination, no individuals from the ministry doing vaccination in the region (see Table 36 and Table 37).

The main barrier for households in CAZ and COFAV for not doing **fish farming** are the insufficient knowledge and capacity, as well as a lack of money, land or water. Some of the respondents said that their activity was destroyed by cyclones and floods. Insecurity and robbers were also reasons mentioned not to do this activity. In some places, fish farming is a “fady”[17]. Time is also something that prevented them to do this activity because they are already engaged in multiple agricultural activities.

The main barriers for households for not **diversifying their livelihood as an adaptation strategy** is insufficient knowledge and capacity for CAZ and COFAV, followed by lack of time, limited money, the perception of not useful or interesting, and insufficient technology.

[17] Taboo that prevent certain families or groups to conduct specific activities.

Table 36: Barriers reported by households who do not use the following adaptation strategies in CAZ for herding

	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Enhancement of animal production *(N_{CAZ}= 270)*	38%	6%	1%	-	4%	13%	1%	23%	29%
Fish farming *(N_{CAZ}= 431)*	15%	27%	-	7%	13%	7%	4%	16%	10%
Livelihood diversification *(N_{CAZ}= 443)*	6%	28%	-	1%	8%	12%	22%	12%	10%

Table 37: Barriers reported by households who do not use the following adaptation strategies in COFAV for herding

	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Enhancement of animal production *(N_{COFAV}= 413)*	45%	30%	-	-	3%	4%	3%	11%	18%
Fish farming *(N_{COFAV}= 389)*	2%	15%	-	2%	7%	6%	1%	3%	1%
Livelihood diversification *(N_{COFAV}= 655)*	18%	25%	-	-	4%	13%	35%	4%	1%

a. Forest products

Reducing forest degradation, diversifying livelihoods, and improving markets are adaptation strategies used by households in CAZ and COFAV when forest and tree products are affected by climate change. On average, 63% of households in CAZ and 53% in COFAV choose to reduce forest degradation. Overall, 33% of respondents are diversifying their livelihoods and 12% are improving market products to adapt (see Figure 27).

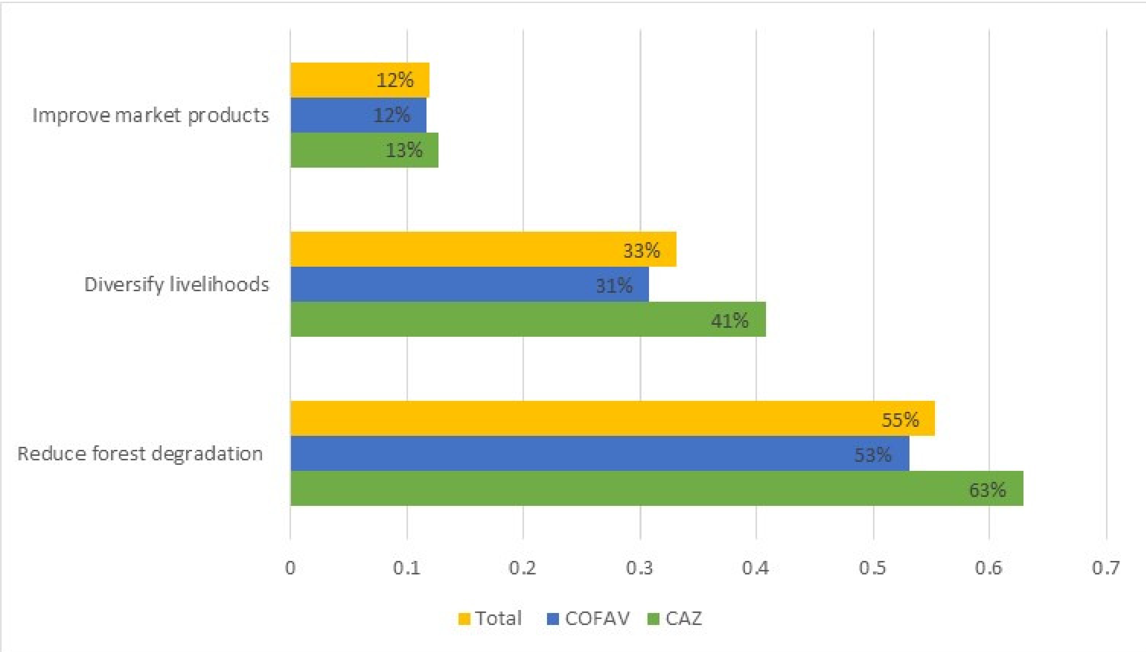


Figure 29: Adaptation strategies used by households facing climate hazards: forest products (N Total= 1822, N CAZ=732; N COFAV=1090)

The main barrier for households that are trying to implement these strategies is a lack of knowledge and skills (see Table 38 and Table 39).

For **livelihood diversification**, the main reasons also include a lack of time and money. The same barriers hinder the enhancement of products as an adaptation strategy. In addition, for the enhancement of market products there is a lack of money and lack of technology. Other barriers identified for **livelihood diversification** were a low production, transportation difficulty to access their home and lack of collectors.

Other barriers for not **improving market products** include : lack of traditional practices, low production, no collectors.

Table 38. Barriers reported by households who do not use the following adaptation strategies in CAZ for forest products

	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Reduce forest degradation *(N_{CAZ}= 260)*	11%	41%	-	6%	1%	23%	5%	9%	3%
Livelihoods diversification *(N_{CAZ}= 431)*	11%	34%	-	1%	10%	14%	17%	10%	3%
Improve market products *(N_{CAZ}= 646)*	13%	44%	-	-	14%	10%	3%	10%	5%

Table 39. Barriers reported by households who do not use the following adaptation strategies in COFAV for forest products

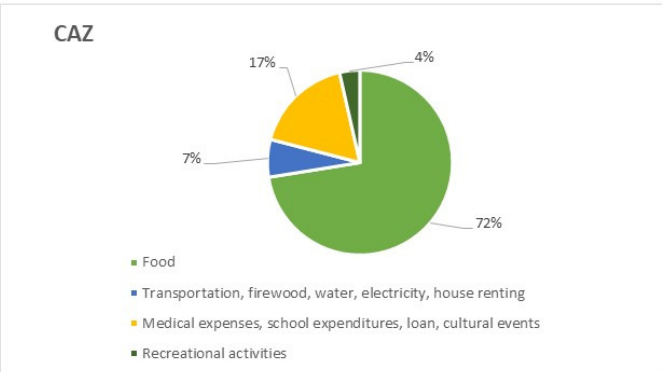
	Lack of money	Lack of knowledge /skills	Lack of labor	Lack of land access	Lack of technology /tools/ infrastructure	Lack of interest/not useful	Lack of time	Other	Do not know/ do not want to respond
Reduce forest degradation *(N_{COFAV}= 529)*	4%	35%	-	-	0%	12%	4%	11%	33%
Livelihoods diversification *(N_{COFAV}= 743)*	12%	29%	-	-	6%	9%	20%	2%	23%
Improve market products *(N_{COFAV}= 960)*	12%	39%	-	-	12%	10%	4%	4%	19%

MODULE F: Food security

In this module, we assess the food security of households in CAZ and COFAV and the change that might have occurred since February 2018. Analysis on food security will be presented later in this document. This part focuses on expenses of households for food, frequent short/medium term expanses (e.g. alcohol, transportation, firewood, water, electricity, house renting) and less regular or long-term expanses (medical expenses, schooling expenditure, loan and cultural events).

a. Expenses of households

In general, share of expenditures across these categories are similar in CAZ and COFAV. Our study shows that food is a major expense for families both in COFAV and CAZ, representing respectively about 74% of total expenses and 73 %. Medical expenses, school expenditures, loan and cultural events, represent about respectively for COFAV and CAZ 15 % and 17 % of total expenses (see Figure 30). Recreational activities (Alcohol, tobacco, and participation to social and cultural events) represent respectively 5% and 4% for COFAV and CAZ.



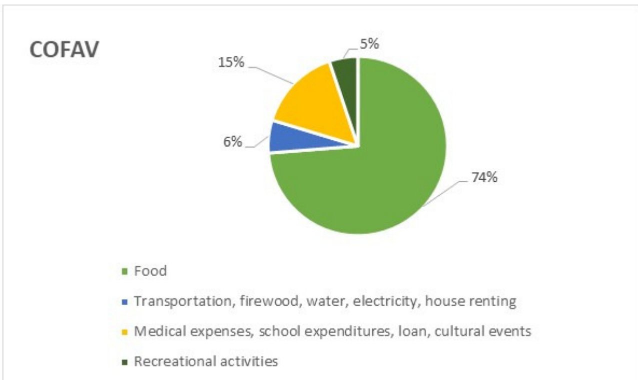


Figure 30: Percentage of Household expenses in CAZ and COFAV during one year (N Total=1793 , N CAZ=728; N COFAV=1065)

Households expenses in a month are on average a little higher in CAZ than in COFAV (93 USD for CAZ and 76 USD for COFAV, see Table 40).

Table 40: Average monthly household expenses during a year

	CAZ	COFAV	Total
N	728	1065	1793
Food (in MGA)	2,907,561	2,403,126	2,524,257
Alcohol, transportation, firewood, water, electricity, house renting (in MGA)	264,196	193,836	210,732
Medical expenses, school expenditures, loan, cultural events (in MGA)	698,055	493,076	542,298
Recreational activities (alcohol, social events)	142,284	168,554	
Total expenses a year	4,012,096	3,258,593	3,439,534
Total expenses in a month (Ar)	334,341	271,549	286,628
Total expenses in a month ($)	**93**	**76**	**80**

b. Livelihood strategies to face food insecurity

The trend is similar for households interviewed in COFAV and in CAZ. The strategies used by the household who faced food insecurity, sorted by decreasing order, are the following: reducing meals (66%), spending savings (40%), harvesting immature plants (31 %), harvesting wild products (15%), changing seed variety (10%), selling last animal female (10%), begging (10%), withdrawing children from schools (7%), selling productive assets (3%), selling land or building (2%) (see Table 41).

Table 41: Livelihood strategy developed by household to face difficult situations

		CAZ	COFAV	Total
	N	732	1090	1822
Spending saving	No, because we didn't face Food insecurity	31%	56%	50%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	31%	3%	11%
	Yes	**38%**	**40%**	**40%**
Reduced meals	No, because we didn't face Food insecurity	30%	28%	28%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	8%	4%	5%
	Yes	**62%**	**68%**	**66%**
Harvest wild products	No, because we didn't face Food insecurity	31%	82%	69%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	54%	3%	16%
	Yes	**14%**	**15%**	**15%**
Changed seeds variety	No, because we didn't face Food insecurity	31%	87%	73%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	58%	2%	16%
	Yes	**11%**	**11%**	**11%**
Withdraw children from school	No, because we didn't face Food insecurity	32%	89%	75%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	62%	3%	18%
	Yes	**6%**	**8%**	**7%**

Harvest immature				
	No, because we didn't face Food insecurity	30%	62%	54%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	45%	4%	15%
	Yes	**24%**	**34%**	**31%**
Sold productive assets				
	No, because we didn't face Food insecurity	32%	95%	79%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	66%	2%	19%
	Yes	**2%**	**3%**	**3%**
Sold land or building				
	No, because we didn't face Food insecurity	32%	96%	79%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	66%	2%	18%
	Yes	**2%**	**2%**	**2%**
Sold last female animal				
	No, because we didn't face Food insecurity	31%	87%	73%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	58%	2%	16%
	Yes	**11%**	**10%**	**10%**
Beg				
	No, because we didn't face Food insecurity	32%	87%	73%
	No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it	61%	2%	17%
	Yes	**7%**	**11%**	**10%**

Module G: Climate awareness and communication

This Module is assessing the knowledge of household heads on climate change, whether they have received information about weather, and advices on how to react facing climate-related hazards and their effects.

a. Weather information

A higher proportion of households in CAZ (85%) received weather information in 2018 compared with households in COFAV (52%) (see Figure 31). The information, for those who received it, had been essentially conveyed by radio and from friends. The use of radio seems more widespread in COFAV compared with CAZ (CAZ: 56 %, COFAV: 71 %), whereas family and friends are more important in CAZ compared with COFAV (CAZ: 40 %, COFAV: 26%) (see Table 42).

The information received was considered as useful by 36% of households in CAZ and 46% in COFAV (see Figure 31). Few household members said that the information they received led to a change in their behavior, with important differences between the two regions (7% for CAZ, 23% for COFAV) (see Figure 33).

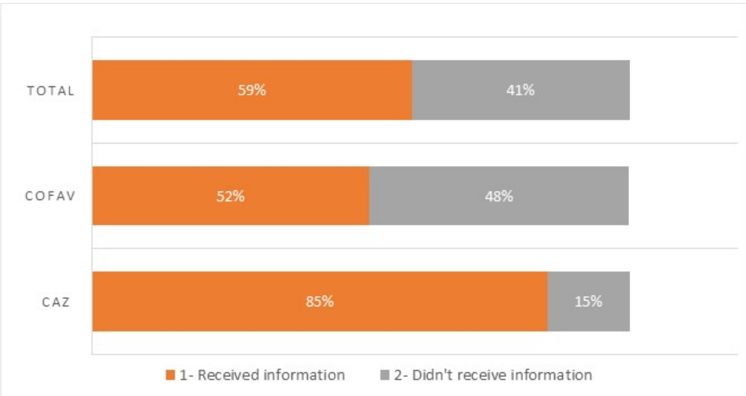


Figure 31: Percentage of Household that received weather information in 2018 in CAZ and COFAV (N Total= 1822, N CAZ=732; N COFAV=1090)

Table 42: Percentage of households that receive weather information by source

	CAZ	COFAV	Total
N	622	564	1186
Radio	56%	71%	66%
Mobile phone	3%	0%	1%
VOI members/ other members of existing associations	2%	2%	2%
Family or friends	40%	26%	31%
Other	-	1%	-

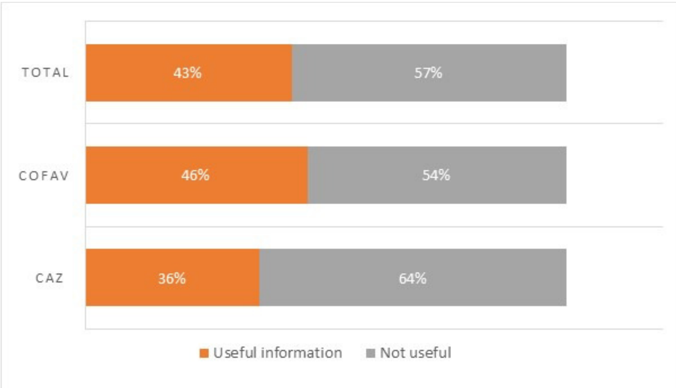


Figure 32: Percentage of Households that reported the weather information they received in 2018 as useful or not (N Total= 1186, N CAZ=626; N COFAV=560)

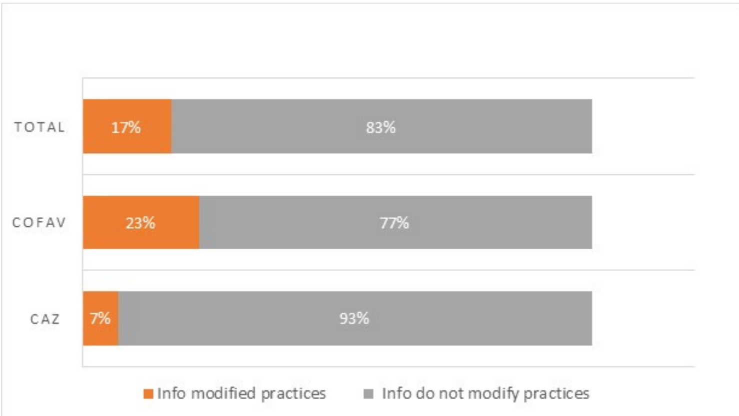


Figure 33: Percentage of Household that reported that the weather information they received in 2018 made them modify their practices (N Total= 1186, N CAZ=625; N COFAV=561)

b. Understanding of Climate Change and of Nature and climate relationship

Less than 20% of the households in CAZ and COFAV have a good understanding of climate change and of the relationship between nature and climate change (see Table 43).

Table 43: Percentage of households by level of understanding of climate change, impacts of climate change and the relationship between nature and climate CAZ and COFAV

		CAZ	COFAV	Total
N		732	1090	1822
Climate change understanding	Do not understand	31%	25%	26%
	Mentioned some correct elements	55%	61%	60%
	Understand well	14%	14%	14%
Impacts of Climate Change	Do not understand	14%	26%	23%
	Mentioned some correct elements	64%	54%	57%
	Understand well	22%	20%	21%
Relationship between nature and Climate Change	Do not understand	24%	44%	39%
	Mentioned some correct elements	59%	39%	43%
	Understand well	17%	18%	18%

Module H: Mitigation

This module is assessing households' perception about the causes of climate-related hazards and of forest degradation. In this module, we also explore the households' perception on forest protection.

a. Forest area quantity change during the last past five years

According to respondents in CAZ and COFAV, perceptions of deforestation differ, with greater concerns about deforestation in CAZ than in COFAV (see Figure 34). Indeed, 47% of households in CAZ consider that deforestation increased (greatly and slightly), and around 22% consider that it decreased (slightly or greatly). In contrast, only 22 % of households in COFAV reported that deforestation increased (greatly and slightly), and most of them (52%) consider that it decreased.

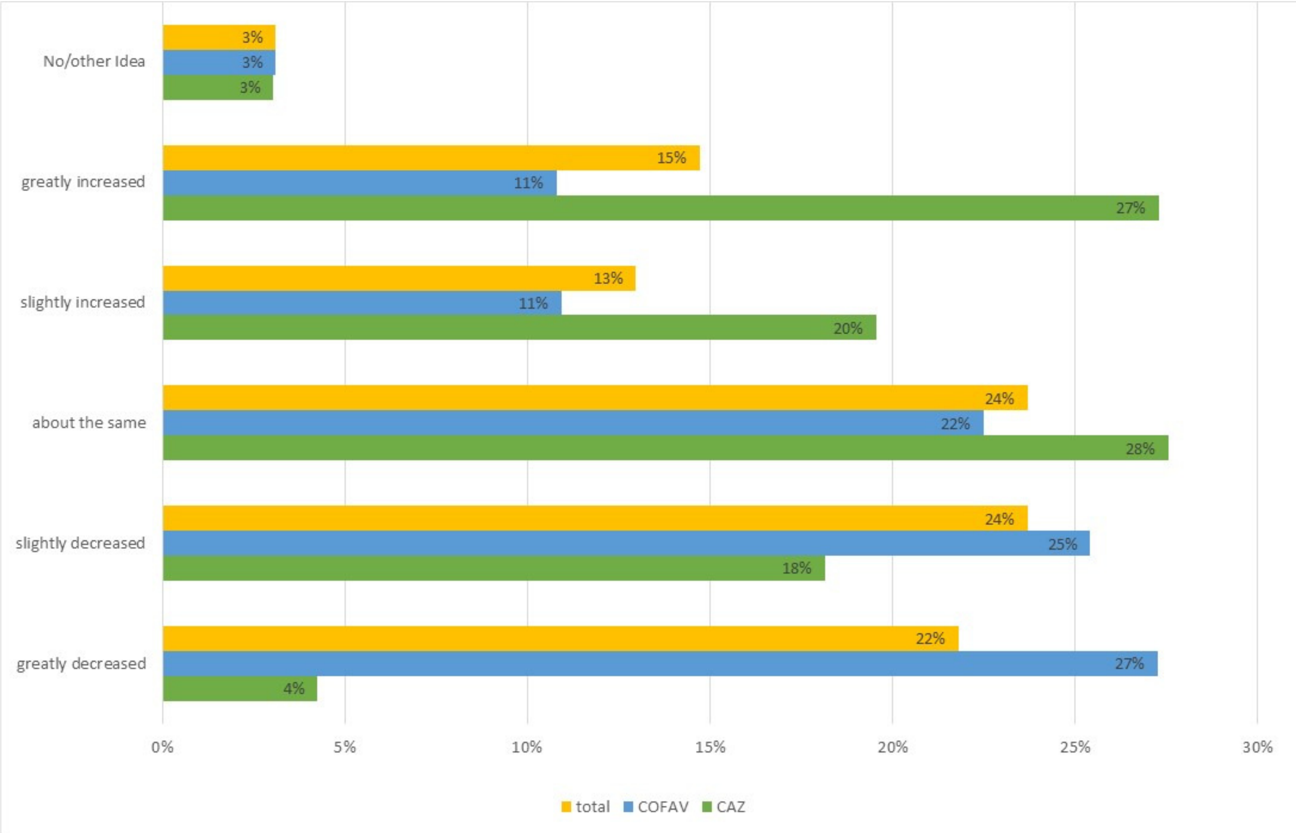


Figure 34: Deforestation perception during the last past five years (N Total= 1822, N CAZ=732; N COFAV=1090)

b. Main causes of deforestation and degradation

The main cause of deforestation and degradation of forests near the villages in CAZ and COFAV is shifting cultivation[18] according to most of the respondents. Natural hazards seem to be the second reason in CAZ, whereas in COFAV the second reason is cropping[19] (see Table 44).

Table 44: The main causes of deforestation and degradation for forest near the villages in CAZ and COFAV during the last five years

	CAZ	COFAV	Total
N	732	1090	1822
Shifting cultivation	45%	49%	48%
Cropping	5%	11%	9%
Timber extraction	5%	5%	5%
Fire wood / Charcoal/NTFP	11%	4%	6%
Natural hazards	16%	6%	8%
illegal mining	8%	1%	3%
No idea	3%	8%	7%
Other	7 %	14 %	14%

In the "other reasons" category, we grouped responses related to fire, settlements creation and expansion, "dahalo"[20] or internal conflicts, food insecurity, increasing needs for land, increasing population (see Table 45).

c. Level of protection satisfaction

About 41.6 % of the total respondents in CAZ and COFAV were very satisfied with the nature protection activities conducted by the VOIs, such as regulations, patrolling and monitoring and law enforcement. This

[18] **Shifting cultivation** or "teviala"in Malagasy is an ancestral practice that consist to cut and burn forest in order to do cultivation.

[19] Cropping is cutting forest only without using fire. The objective is to collect wood for domestic use (eg: firewood etc).

[20] Group of robbers who are stealing mainly cows. We can observe a lot of them in southern Madagascar areas such as Ihosy, Beraketa, Ranohira, Ambosary atsimo.

percentage is higher in COFAV (46%) compared with CAZ. A higher percentage of respondents in CAZ were not satisfied about the protection activities (see Figure 35).

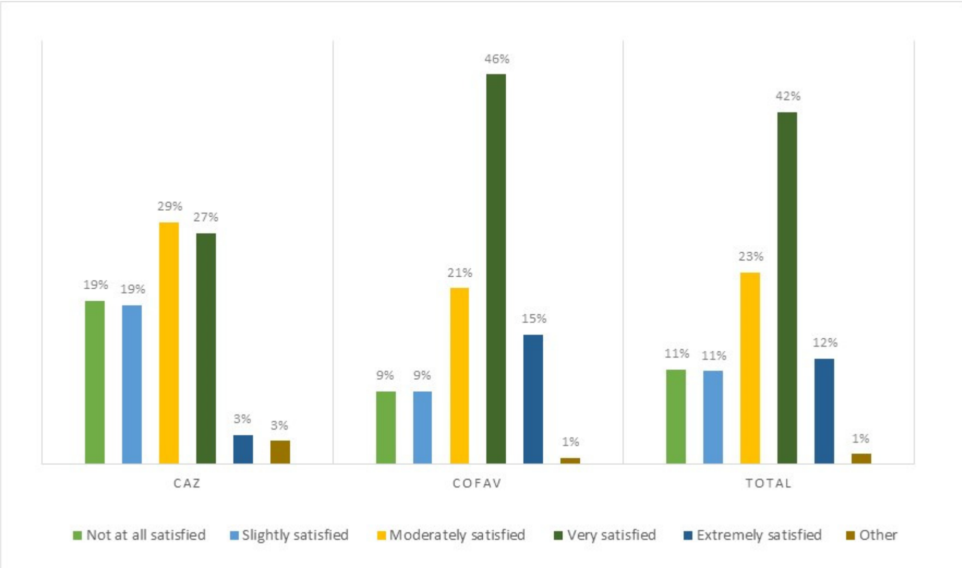


Figure 35: Level of protection satisfaction of CAZ/COFAV forest corridor (regulations, patrolling and monitoring, law enforcement) (N Total= 1822, N CAZ=732; N COFAV=1090)

d. Perception of Illegal activities in the Protected Area

Most of the respondents interviewed considered that illegal activities in the Protected Area is never acceptable (66% in CAZ and 85.5 % in COFAV). However, more respondents in CAZ consider that illegal activities are acceptable under some conditions (see Figure 36).

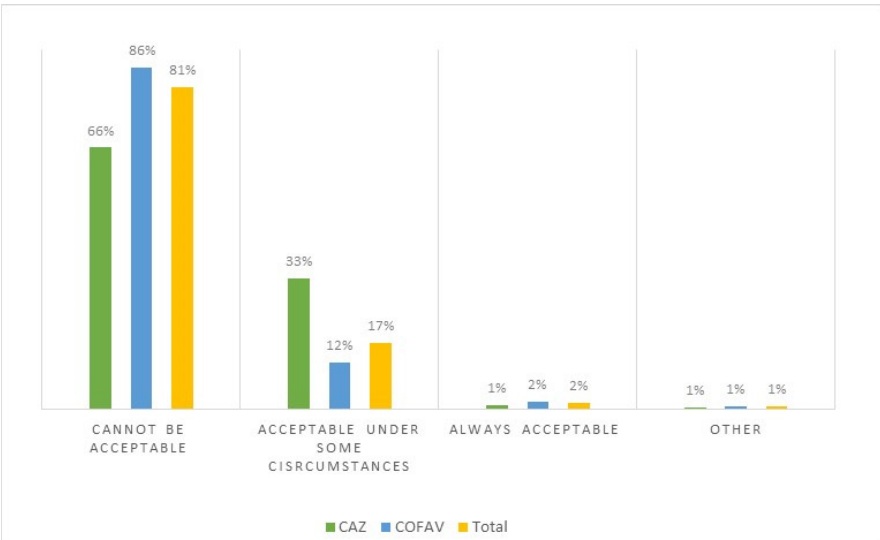


Figure 36: Illegal activities perception in the Protected Area (N Total= 1822, N CAZ=732; N COFAV=1090)

e. Reporting of illegal activities to the VOI/Authority

A majority of respondents do not report any illegal activities to the VOI or authority (64% for CAZ and 80% for COFAV) (see Figure 37). A relatively small proportion of respondents report illegal activities to VOI or authority for COFAV (20 %) whereas in CAZ the proportion is higher (35%).

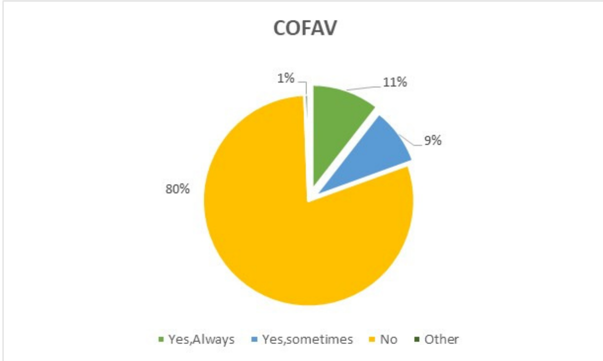


Figure 37: Reporting a violation of the rules in the Protected Area to the VOI/Authorities

(N Total= 1822, N CAZ=732; N COFAV=1090)

Reasons for not reporting violation in the Protected Area to the VOI or authorities are mostly because of being afraid to have internal conflicts and preserve social relationship. Many of the respondents also think that this is not their role but the responsibility of the VOI patrollers. Moreover, fokontany and VOIs are located far from certain homes.

f. Reliance on Protected Area for food and income

Following CAZ and COFAV respondents, around 57% think that households rely a lot less on Protected Area compared to the previous year (2018). The trend is similar for COFAV and CAZ (see Figure 38).

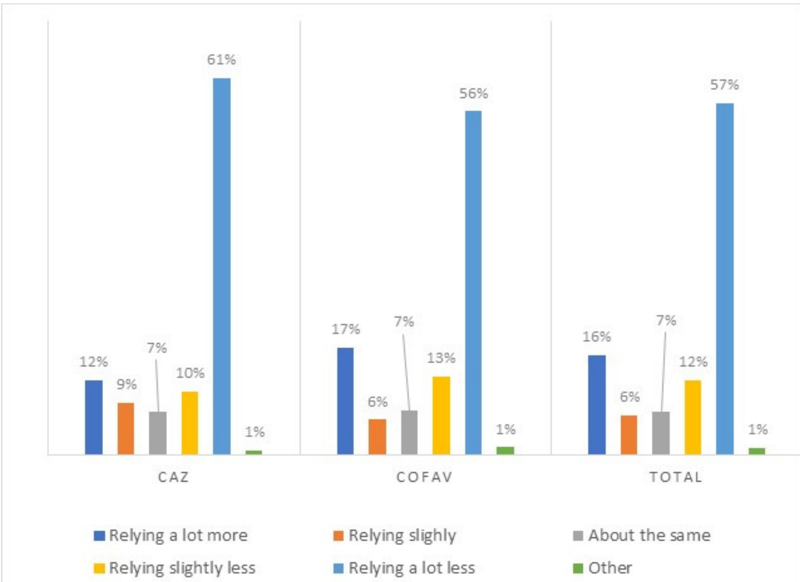


Figure 38: Relying more or less, on Protected Areas for food and income, compared to 2018

g. Key forests to be protected or restored

In CAZ, there are fewer people that identified key forests to be restored or protected compared with COFAV (see Figure 39).

A list of forests to be restored in CAZ and COFAV is inserted in Appendix 3.

Figure 39. Existence of Key forest areas to be restored or protected
(Important to help during climate-related hazard) (N Total= 1822, N CAZ=732; N COFAV=1090)

h. Importance of VOI

Most of the respondents in CAZ and COFAV agreed that VOIs are important institutions to help manage the forest and natural resources more sustainably and equitably. Specifically, 87% respondent in CAZ (32% think VOI is extremely important and 54 % think that VOI is important) and 93 % respondent in COFAV (41% think VOI is extremely important and 52% think that VOI is important) (see Figure 40).

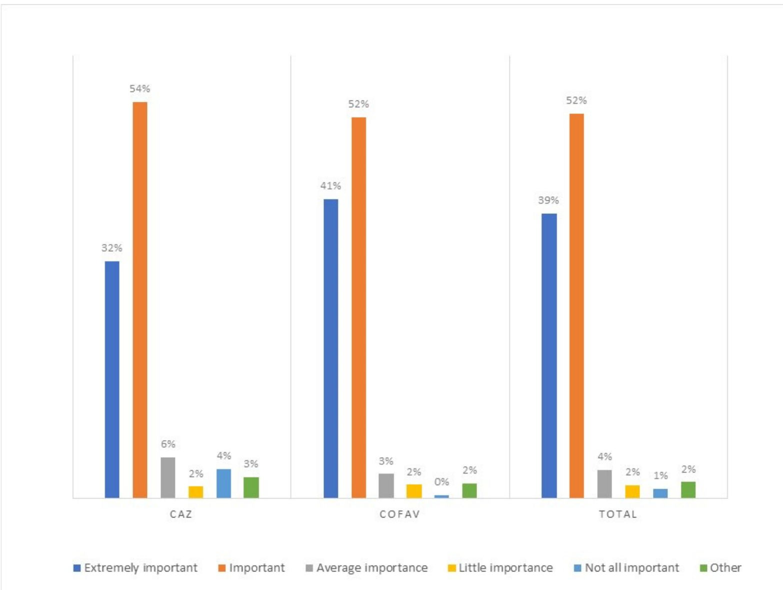


Figure 40. Importance of VOI to help manage the forests and natural resources more sustainably and equitably (N Total= 1822, N CAZ=732; N COFAV=1090)

i. Inclusion in VOI decision-making

Men’s and women’s voice seem to be considered when decisions need to be made in the VOI in most of the cases in COFAV and CAZ (see Figure 41). Around 83% of respondents perceived that men are considered in decision making in VOI in CAZ and 78% in COFAV. However, only 71% of the respondents in CAZ and 65% in COFAV agreed that it is consistently the case. In contrast, 43% of respondents said that women are considered when making decisions, whereas 24 % said they are not. Women’s voice seems more considered in CAZ compared to COFAV (43% in CAZ against 24% in COFAV). In other category for woman, seems that 57% in COFAV and 59% of respondent, didn’t feel concerned about this question.

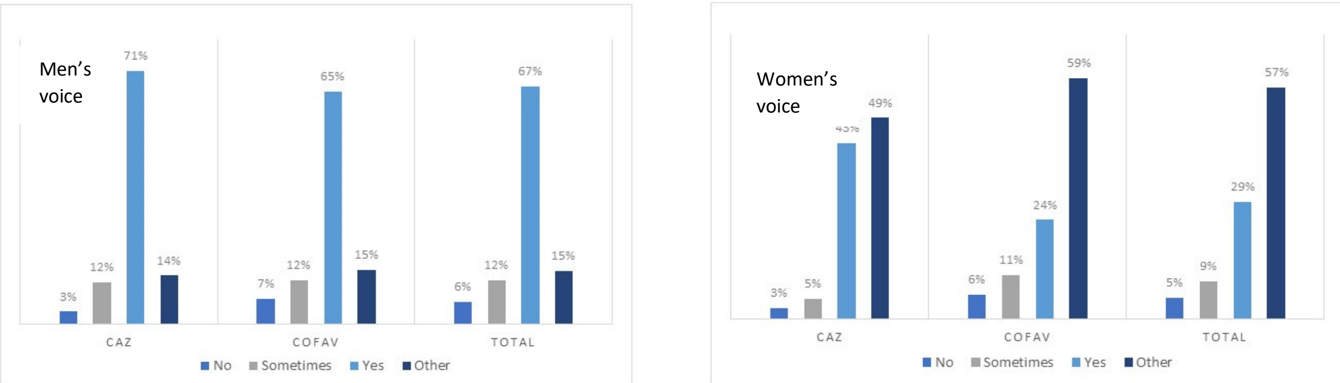


Figure 41. Consideration of respondent’s voice and involvement in decision making in the VOI (on the left men’s voice, on the right women’s voice)(N Total= 1822, N CAZ=732; N COFAV=1090)

Module I: Markets

In this module, we asked the households whether any member of the household going to sell agricultural, animal or / and animal production as well as forest products to the market and their strategies.

a. Market types

Only few households do not sell their products in local markets in both COFAV and CAZ (9% and 5% respectively) (see Figure 42).

The results show that a higher number of Households in COFAV (67%) go to municipalities' markets to sell their production compared to household in CAZ (16%). COFAV households also go to other markets outside the village (13%), and fewer of them work with collectors (2%) (see Figure 42). Other ways to sell products is along the road, door by door, or having a little market at home.

In CAZ, households have more diversified way to sell products, more of them use market located outside the village (27%), more households are selling products in their own village (23%), and more of them use collectors (22%).

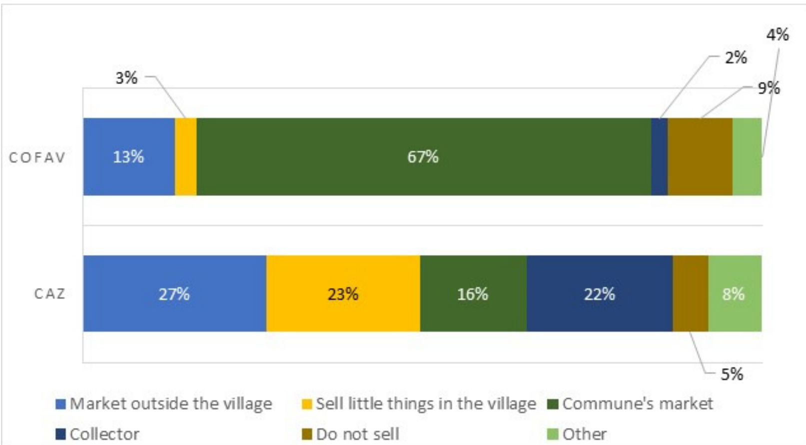


Figure 42. Different types of markets within COFAV and CAZ
(N Total= 1814, N CAZ=732; N COFAV=1082)

b. Distance to market

According to the households interviewed, their average distance to the nearest market where they sell their products is about 2 hours for CAZ and COFAV. However, the types of markets are different in CAZ. They do not have to reach communes market, and their products is sold through collectors, in village nearby, or inside the same village, so that the median value is only 15 minutes in this region (see Table 45).

Table 45: Distance to markets for communities

	CAZ	COFAV	TOTAL
N	683	1008	1691
Average distance to market (min) ±SD	133 ± 153	128 ± 56	129 ± 90
Median value (min)	*(15)*	*(120)*	*(90)*

c. Main barriers for selling products

Through our analysis, the households faced some barriers to sell agricultural, herding and their forest products such as roads conditions and low prices of products. Around 43 % and 46% of households in COFAV and CAZ respectively said that their main concern is related to access: inexistence of roads or in bad shape, distance to markets and also transportation of products to market. Interestingly, 23% of households in CAZ and 12 % in COFAV reported that they do not face any barrier. In addition, the responses of the households classified in the "other reasons" categories had difficulties to sell their products because of bad production, or no production, no common market / no value chains, no buyers/ collectors, age of the household head, mistrust in weighting products/ gendarmes; market's ticket (fees that need to be paid), lack of money, prices volatility, internal conflicts, papers/ taxes in market, and lack of time (see Figure 43).

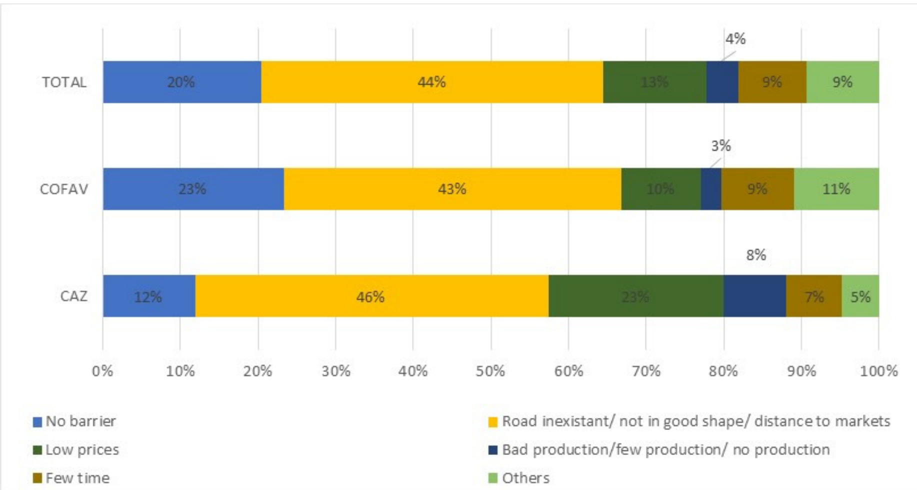


Figure 43. Main barriers for selling agricultural, animal, forest products within COFAV and CAZ (N Total=1692, N CAZ=732; N COFAV=960)

d. Main strategies undertaken to increase production price

In CAZ and COFAV, very few people are doing strategies to increase production (see Figure 44).

In COFAV and CAZ, most of the households selling products increase their production price by adding value to their products. Among the strategies mentioned, there are the enhancement of production through transformation of products (handcrafts, or alcohol obtained through sugar cane) or the use of natural fertilizers for agricultural products, or vaccination of livestock, storage of products and waiting for increasing prices (rice). In addition to get higher income, people reported searching for buyer that can afford high prices, increasing the size of lands and increasing quality of products in using quality-value-enhancing technics, increasing the quantity of products in high demand (rice, poultry, pig herding), using storage and wait for higher prices before selling their products, and changing the timing of cultivation (to sell during leaning season).

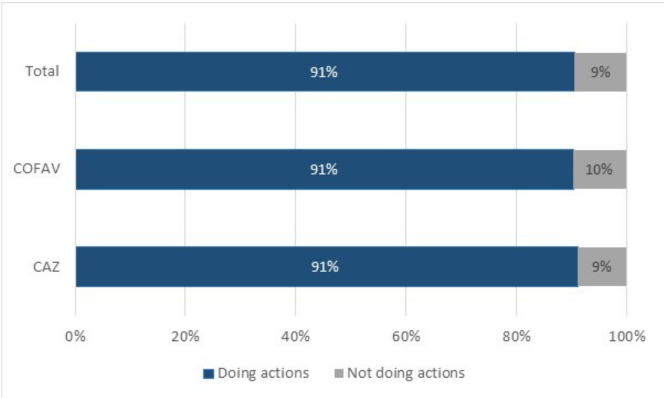


Figure 44: Percentage of household doing actions or not to improve productions (N Total= 1821, N CAZ=731; N COFAV=1090)

e. Information on market and product prices

Many households did not receive any information the last 12 months about market and products prices. Only 27% of households interviewed said that they received information (see Figure 45).

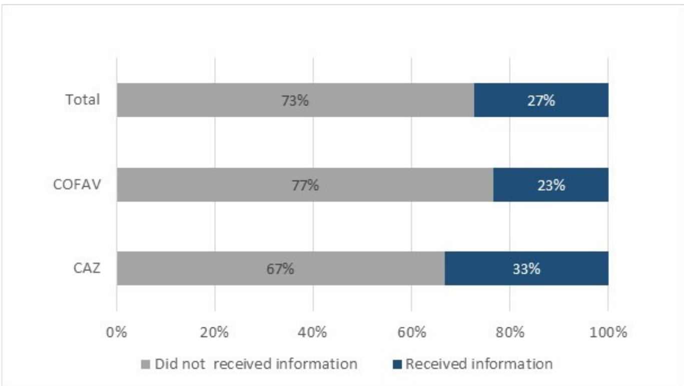


Figure 45. Percentage of households receiving information about market and product prices the last 12 months
(N Total= 1821, N CAZ=731; N COFAV=1090)

f. Source of information on market and products price

Our study shows that the main way household obtained information about market and products price is through family and friends (56% for COFAV and 62% for CAZ). After that, the radio seems also to be a good way to convey this information (32% for COFAV and 28% for CAZ) (see Figure 46).

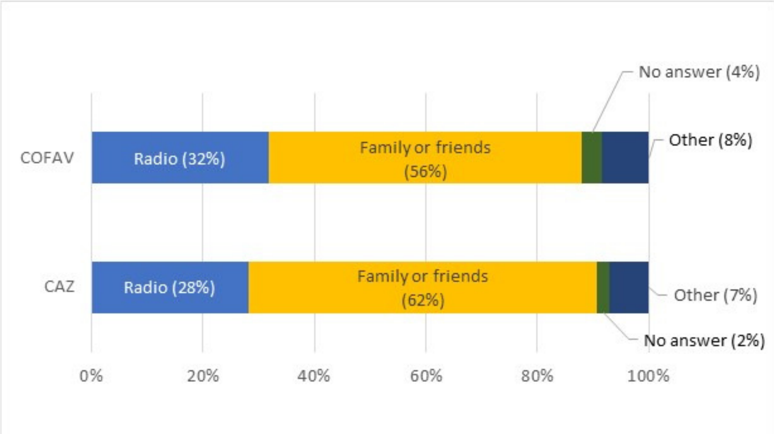


Figure 46. sources of information about market and product prices in the last 12 months
(N Total= 528, N CAZ=258; N COFAV=270)

g. Use of information on market and products price

More households in COFAV think that the information received about market and products price the last 12 months is useful (45%) compared with CAZ (22%) (see Figure 47).

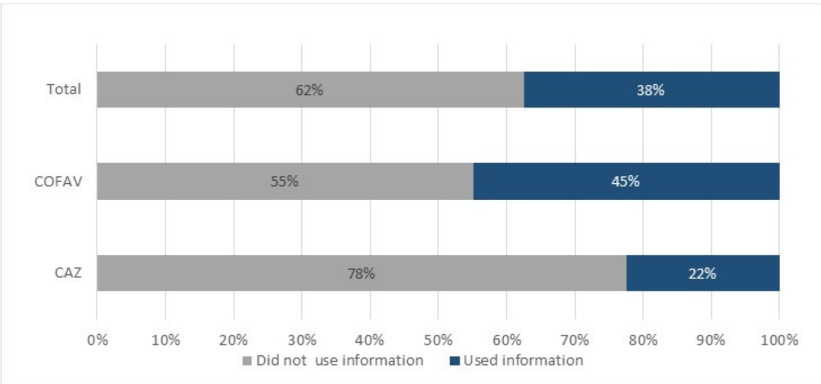


Figure 47. Percentage of households that received information about market and products prices having used this information
(N Total= 528, N CAZ=258; N COFAV=270)

Many suggestions were followed by households reporting a change in their behavior:

- Price of agricultural products were adjusted as a result of discussion with people for some households. In addition, information received also helped some households to change the timing of agricultural practices so that they were able to get higher prices.
- Agricultural production was enhanced by improved technics. This is the case for alcohol production, pig production, vaccination of chicken, and cane herding. The use of natural fertilizers to cope with animal pests (using comfrey leaves [21] added with sisal and cow dung) was also used after getting information about this technique.
- Vanilla cultivation, cassava production, ginger production, were also practiced as livelihood diversification strategies after receiving advices as well as multi-cropping cultivation and change in seeds.

h. Affiliation to groups or associations

Several respondents are part of multiple associations, such as farmers, women or youth associations. Around 1% of households surveyed (6 households in total), even if they are classified in the list of VOI, they reported not to be members of VOI at all. Household members can be also a member of other associations located in the same village. For COFAV, 33% of households are member of association of women as well, whereas for CAZ this is the case for 10% of them (see Table 46).

[21] "Consoude" in French: The root and leaves of the comfrey plant have been used in traditional medicine in many parts of the world and is used to fight against animal pests.

Table 46: Memberships of Households in VOI in other associations in COFAV and CAZ

	CAZ	COFAV	Total
N	732	1090	1822
VOI	99%	99%	99%
Farmer group	1%	13%	10%
Restauration or reforestation group	1%	7%	5%
Aquaculture group/	0%	3%	2%
Collectors' group	0%	1%	1%
Water management group	0%	3%	2%
Loan's group	2%	1%	1%
Group of product vendors	1%	2%	1%
Group of enhancers of products	1%	2%	1%
Woman association	10%	33%	27%
Young association	4%	14%	12%
Risk Management association	1%	2%	1%

Module J: Assets, equipment and labor

In this module, the assets and materials owned by households in CAZ and COFAV were investigated but also the use of labor during rice cultivation/processing and other products cultivation/ processing.

a. Assets and equipment

In terms of communication, about 50 % of households do not have a radio in CAZ and COFAV. Few of them have a mobile phone, 35 % for CAZ and 25 % for COFAV.

Some households do not have any bed in CAZ and COFAV (11% for CAZ and 34 %) in COFAV. The use of solar panel is higher in CAZ (49%) compared with COFAV (21%). About 60 % of households use petrol lamp. Few households own sewing machines in CAZ and COFAV, but this figure is lower in COFAV (7%) compared with CAZ (13%) (see Table 47).

Most of the households in CAZ and COFAV own basic equipment for agriculture such as cleavers (98% for CAZ and 88 % for COFAV), machete (96% for CAZ and 94% for COFAV), or canisters (64% for CAZ and 65 % for COFAV). Storage rooms are existing in households for about 41% for CAZ and 59 % for COFAV. Herse, a material that is expensive for Malagasy people, is more present in households in CAZ (45%) compared with COFAV (12 %) as well as plough that is a material consider to be not affordable by everyone (45% for CAZ and 35%). Kubota tractor is used by 8% of households in CAZ only.

Table 47: Assets and equipment available in households in CAZ and COFAV

		CAZ	COFAV	Total
	N	732	1090	1822
Communication	Mobile Phone	35%	25%	27%
	Radio	46%	53%	51%
	Television	11%	2%	4%
	Internet access	1%	1%	1%
	Mobile banking	8%	5%	5%
	VHS reader	18%	6%	9%
	Amplifier	20%	5%	8%
	N	732	1090	1822

Assets	Bed	89%	66%	72%
	Sewing machine	13%	7%	8%
	Generator	6%	1%	2%
	Petrol Lamp	58%	59%	59%
	Solar panel	49%	21%	28%
	Improved cooking stoves	3%	5%	5%
	N	732	1090	1822
Agricultural equipment	Cleaver (big knife)	98%	88%	97%
	Machete	96%	94%	96%
	Plough	45%	35%	44%
	Chainsaw	1%	12%	2%
	Storage room facilities	41%	59%	44%
	Motor pump	1%	0%	1%
	Sprayer	100%	100%	100%
	Rice husker	6%	0%	5%
	Kubota tractor	8%	0%	7%
	Herse	45%	12%	40%
	Watering canister	64%	65%	64%
	N	732	1090	1822
Transportation	Tractor or motorcycle	3%	1%	1%
	Bicycle	16%	3%	6%
	Motorcycle/ Moped	3%	0%	1%
	Oxcart	4%	0%	1%

b. People that participate to land preparation and processing of rice and other productions

1. Rice

Households in CAZ and COFAV use on average 14 people and 17 people respectively for land preparation for rice cultivation. This process takes about 36 days in CAZ and 21 days in COFAV. Rice processing takes an average of 11 people in CAZ and 18 people in COFAV (see Table 48).

Table 48: Days and number of people working on households' land for rice production/ Days and number of people working for rice processing

	CAZ	COFAV	Total
	726	1066	1792
Number of people used for land preparation for rice cultivation ± SD	14 ± 11	17 ± 9	17 ± 10
Median	*(7)*	*(10)*	*(9)*
Number of days for land preparation ±SD	36 ± 17	21 ± 14	24 ±15
Median	*(30)*	*(10)*	*(15)*
Number of people used for rice processing ± SD	11 ± 0	18 ± 0	16 ± 0
Median	*(6)*	*(9)*	*(8)*
Number of days for rice processing ± SD	*14* ± 9	*6* ±3	*7* ± 5
Median	*(9)*	*(2)*	*(3)*

2. Other crops

Other crops cultivation takes fewer days and less people for land preparation and processing. Land preparation take only 5 people for CAZ on average and 7 people for COFAV on average. The number of days for land preparation for other crops can take 19 days for CAZ and 15 for COFAV (see Table 49).

Processing other crops such as cassava, sweet potatoes, vegetables only require a few people on average, 4 for CAZ and 3 for COFAV. The number of days for processing is higher for COFAV compared to CAZ, with 71 days for COFAV and 10 for CAZ.

Table 49: Days and number of people working on households' land for other production / Days and number of people working for rice processing

	CAZ	COFAV	Total
N	717	1073	1790
Number of people used for land preparation for other crop ± SD	5 ± 5	7 ± 7	7 ± 4
Median	*(3)*	*(5)*	*(4)*
Number of days for land preparation for other crop ± SD	19 ± 11	15 ± 9	16 ± 9
Median	*(10)*	*(7)*	*(7)*
N	*716*	*1057*	*1773*
Number of people used for other crop processing ± SD	4 ± 3	3 ± 2	3 ± 2
Median	*(3)*	*(2)*	*(2)*
N	*716*	*1057*	*1773*
Number of days for processing (others crop) ± SD	10 ± 8	71± 43	56 ± 38
Median	*(5)*	*(30)*	*(10)*

VI. RESULTS ON THE CLIMATE CHANGE VULNERABILITY

Overall the average vulnerability index of the sample is 2.7 (see Figures 48 to 50), which means that, on average, the sample size has a climate change vulnerability between moderate and severe. The tables below present the results on the vulnerability index at baseline. There is no statistical difference between the average climate change vulnerability of households in CAZ and COFAV, neither between households assigned for phase 1 and phase 3. There is, however, a statistically significant difference in the average climate change vulnerability between households led by a man and a woman, with the latter more vulnerable than the former. Likewise, there is a statistically significant difference in the average climate change vulnerability between households located inside and outside VOIs, with the latter more vulnerable than the former. There was also a difference in the climate change vulnerability of control households and those assigned to phase 3 of the project implementation (see Tables 50 to 55). Figures 51 and 52 display the average vulnerability index of interviews households by municipality. While the Western part of CAZ appears on average more vulnerable than the Eastern part, there is no visible pattern for COFAV.

Table 50: Climate change vulnerability index for households located in COFAV and CAZ, based on the baseline data.

	COFAV	**CAZ**	**Average difference**	**T-test (p-value)**
N	1635	1094		
Vulnerability index ± SD	2.7±0.3	2.7±0.3	0.2	0.5
	Moderately vulnerable	Moderately vulnerable		

Table 51: Climate change vulnerability index for households led by man and woman, based on the baseline data.

	Woman	**Man**	**Average difference**	**T-test (p-value)**
N	510	2220		
Vulnerability index ± SD	2.7±0.3	2.6±0.3	0.1	<0.00001*
	Severely vulnerable	Moderately vulnerable		

Table 52: Climate change vulnerability index for households located outside and inside VOIs, based on the baseline data.

	Control	VOI	Average difference	T-test (p-value)
N	908	1822		
Vulnerability index ± SD	2.7±0.3	2.6±0.3	0.1	<0.00001*
	Severely vulnerable	Moderately vulnerable		

Note: t-test with weighted averages and standard errors clustered at VOI level. * statistically different

Table 53: Climate change vulnerability index for households assigned to phase 1 and phase 3 during implementation of project activities, based on the baseline data.

	Phase 3	Phase 1	Average difference	T-test (p-value)
N	838	987		
Vulnerability index ± SD	2.6±0.3	2.7±0.3	-0.1	0.2
	Moderately vulnerable	Moderately vulnerable		

Note: t-test with weighted averages and standard errors clustered at VOI level. * statistically different

Table 54: Climate change vulnerability index for households assigned to phase 1 and control during implementation of project activities, based on the baseline data.

	Control	Phase 1	Average difference	T-test (p-value)
N	887	987		
Vulnerability index ± SD	2.7±0.3	2.7±0.3	0.1	0.1
	Severely vulnerable	Moderately vulnerable		

Note: t-test with weighted averages and standard errors clustered at VOI level. * statistically different

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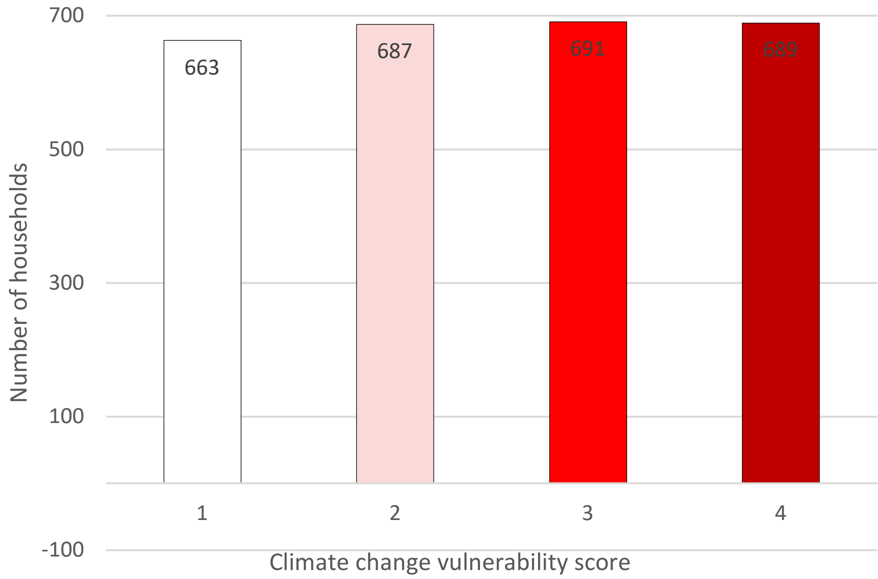

Figure 48. Number of households in each climate change vulnerability index (1=marginally vulnerable, 2-moderatelly vulnerable, 3= severely vulnerable and 4=extremely vulnerable)

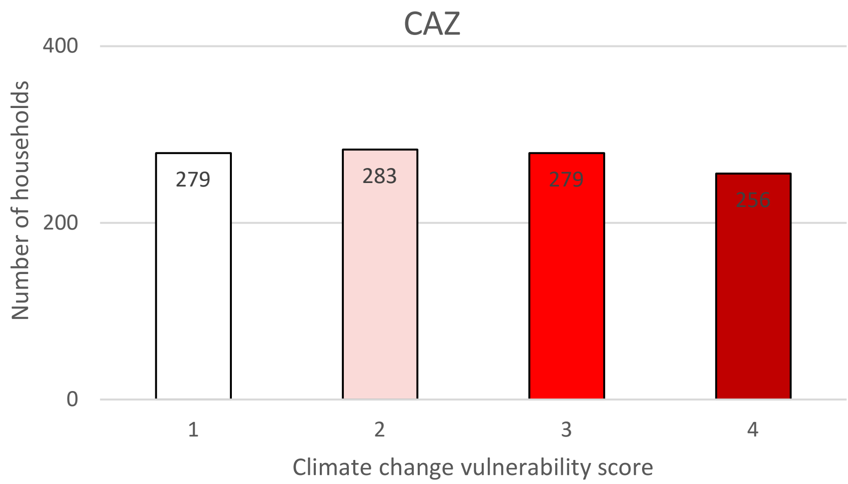

Figure 49. Number of households in CAZ in each climate change vulnerability index (1=marginally vulnerable, 2-moderateltyy vulnerable, 3= severely vulnerable and 4=extremely vulnerable)

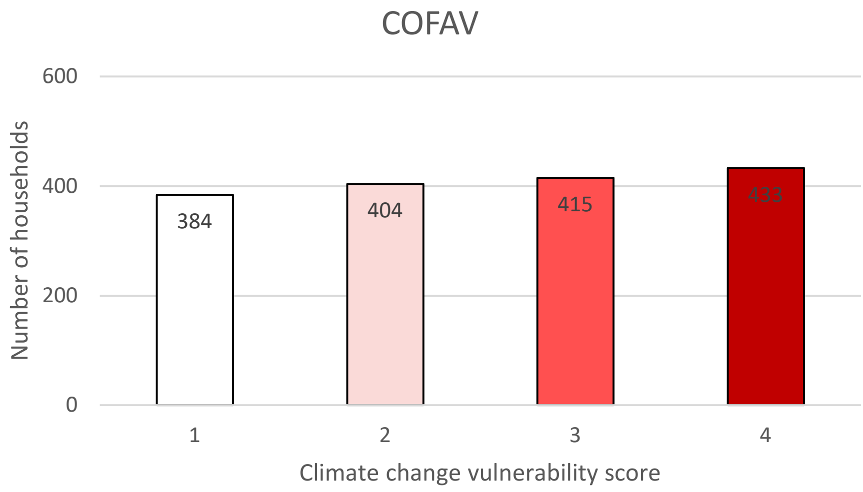

Figure 50. Number of households in COFAV in each climate change vulnerability index

(1=marginally vulnerable, 2-moderatelly vulnerable, 3= severely vulnerable and 4=extremely vulnerable)

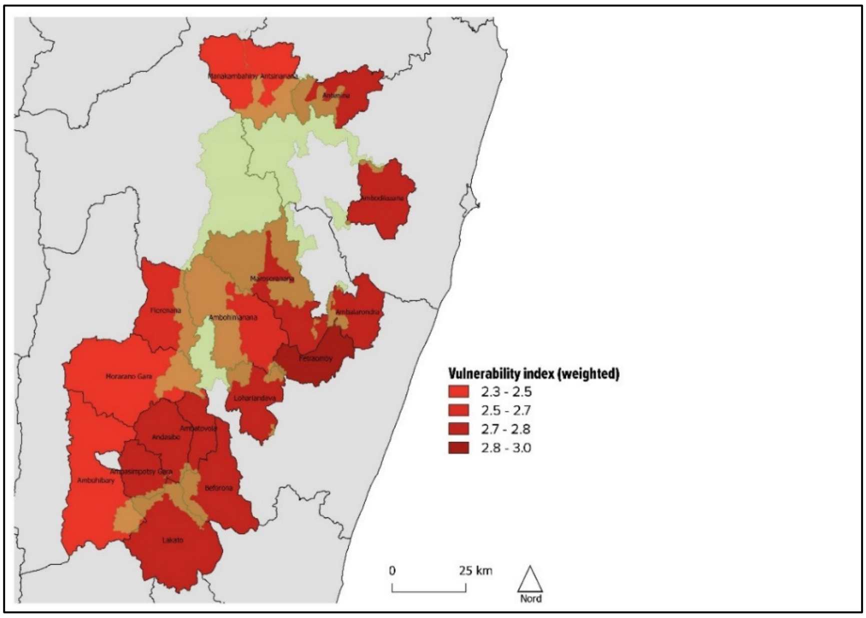

Figure 51: Map of CAZ municipalities and their level of vulnerability to climate change

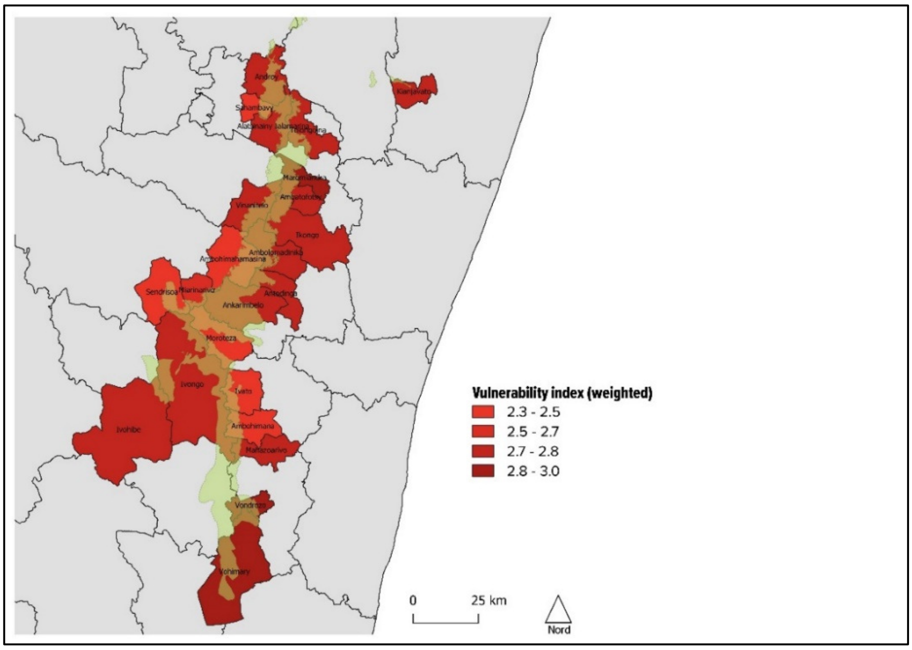

Figure 52. Map of COFAV municipalities and their level of vulnerability to climate change

VII. Results on food security

The households in the project areas suffer from food insecurity issues (see Table 56 and Figures 53 and 54). On average, the households in CAZ are marginally food secure, whereas the households in COFAV are moderately food insecure. The households in COFAV have a statistically significant higher food insecurity compared to those in CAZ (t-test with weighted averages and standard errors clustered at VOI level).

Table 55: Food security index for households located in COFAV and CAZ, based on the baseline data.

	CAZ	COFAV	Average difference	T-test (p-value)
N	1094	1635		
Food Security Index ± SD	2.1 ± 0.7	2.4± 0.7	-0.3	<0.00001 *
	(2 - Marginally Food Secure)	(3 - moderately food insecure)		

Note: t-test with weighted averages and standard errors clustered at VOI level. * statistically different at a significant level of 5%

Households led by women do not statistically differ in their food security situation compared to those led by men, even though women-led households have a slightly higher food insecurity (see the average difference in Table 57).

Table 56: Food security index for households led by man and woman, based on the baseline data

	Man	Woman	Average difference	T-test (p-value)
N	2220	510	0.01	0.877
Food Security Index ± SD	2.4 ± 0.7	2.4 ± 0.7		

Note: t-test with weighted averages and standard errors clustered at VOI level.

The households in different phases (Phase 1-2), and Phase 3 and Control Group do not have statistically different food security indexes. However, the average food security for the households in Phase 1 and Control Group are statistically different (Tables 58 to 60).

Table 57: Food security index for households assigned to phase 1 and phase 3 during implementation of project activities, based on the baseline data.

	Phase 1	Phase 3	Average difference	T-test (p-value)
N	987	838	0	0.918
Food Security Index ± SD	2.5 ± 0.7	2.5 ± 0.7		

Note: t-test with weighted averages and standard errors clustered at VOI level.

Table 58: Food security index for households assigned to phase 1 and control during implementation of project activities, based on the baseline data.

	Phase 1	Control	Average difference	T-test (p-value)
N	987	887		
Food Security Index ± SD	2.5 ± 0.7	2.3 ± 0.7	0.2	0.045*

Note: t-test with weighted averages and standard errors clustered at VOI level. * Statistically different (p<0.1)

Table 59: Food security index for households assigned to phase 3 and control during implementation of project activities, based on the baseline data.

	Phase 3	Control	Average difference	T-test (p-value)
N	838	887	0.2	0.135
Food Security Index ± SD	2.5 ± 0.7	2.3 ± 0.7		

Note: t-test with weighted averages and standard errors clustered at VOI level.

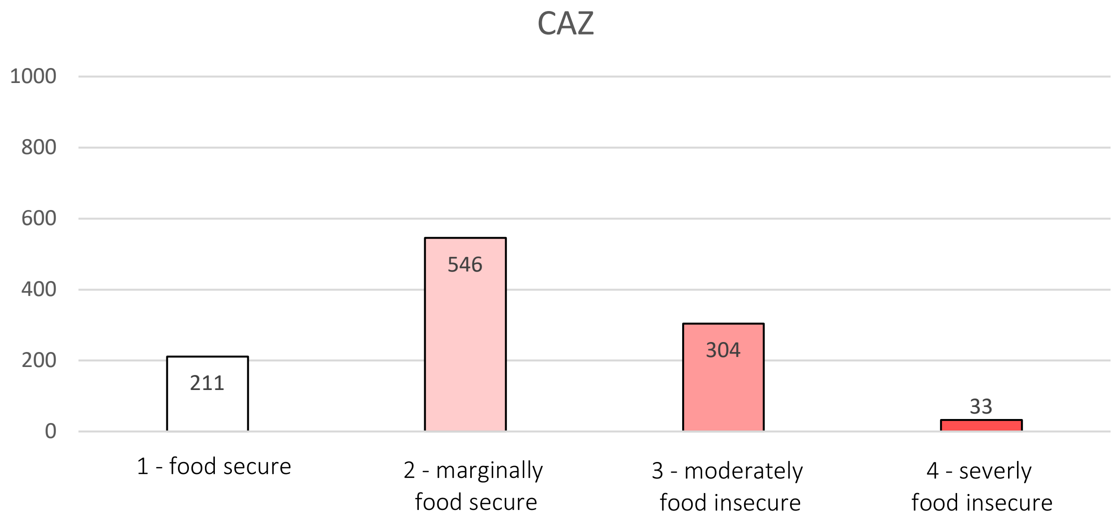

Figure 53. Distribution of the number of households in CAZ along each category of the food security index

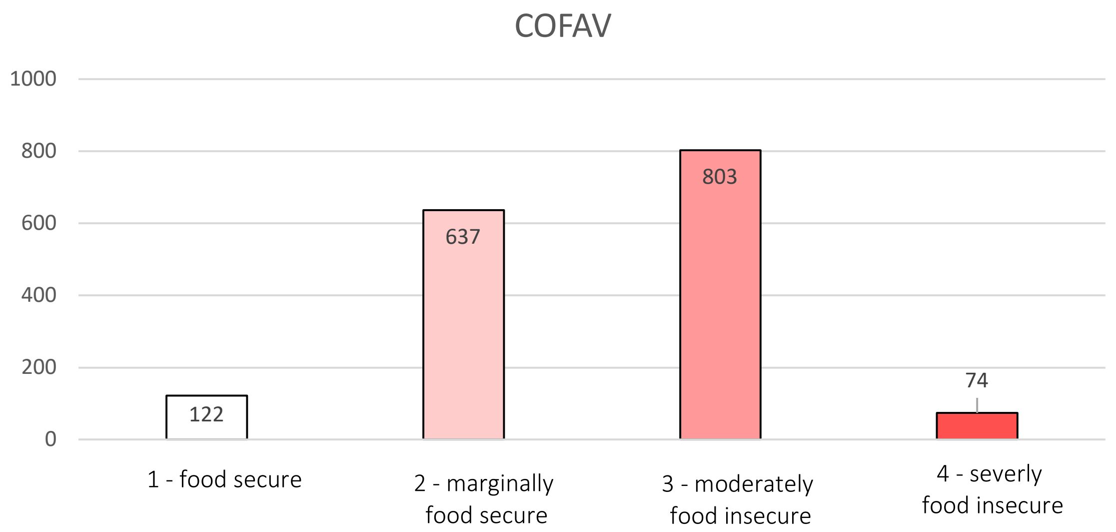

Figure 54. Distribution of the number of households in COFAV along each category of the food security index

Figures 55 and 56 display the average food security index of interviewed households by municipality in CAZ and COFAV.

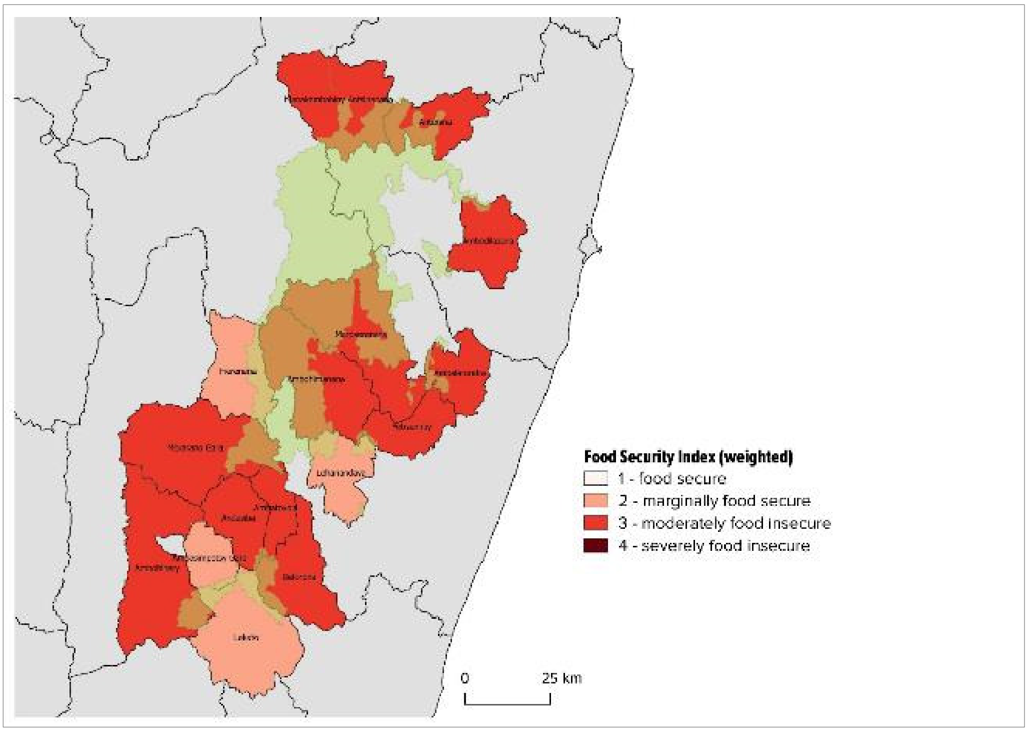

Figure 55: Map of CAZ municipalities and their food security

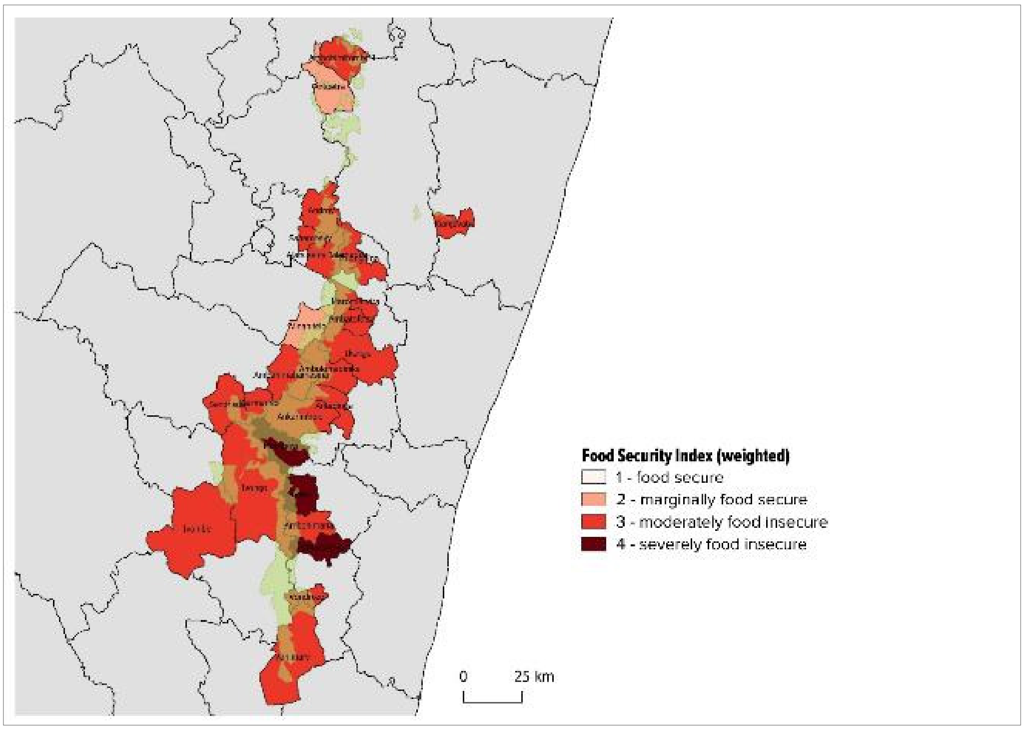

Figure 56: Map of CAZ municipalities and their food security

VIII. Balances tests results

A comparison between households in the treated group and in the comparison groups allows us to assess the validity of our proposed strategies of identification of the impacts of the program.

To assess the extent of the similarity between the two groups, we compare initial characteristics that could affect the outcomes of interest, and the baseline values of these outcomes, by the means of mean difference tests (t-tests), also referred to as balance tests. These tests are used to calculate whether differences between the two groups are statistically sufficiently certain (statistically significant). As long as these differences are not statistically significant, the groups will be considered to be on average similar in these characteristics. If these groups are indeed on average similar, any differences arising after the program can be attributed to SLEM interventions. In the case differences arise, these need to be taken into account in the estimation of the impacts of the SLEM program.

Two kinds of bilateral comparisons are conducted: a comparison between phase 1 VOI and phase 3 VOI, and a comparison between phase 1 VOI and the outside comparison group. The mean difference tests account for sampling weights and standard errors were clustered at the VOI level for the first type of comparison and at the Fokontany level for the comparison between phase 1 VOI and the outside comparison group. Clustering standard errors allows us to account for the correlation between households within VOI and Fokontany, as well as for the level of clustering of the program. The results of these balance tests are displayed in Appendix 1. Each balance table is organized into 6 columns. The first column provides the variable name, the second and fourth columns report the number of observations (households) in respective groups, the third and fifth columns display the means of these variables in each of the compared groups, and the last column informs on the statistical significance of the mean difference tests in the form of the p-value.[22] A p-value superior to 0.10 indicates that the observed difference between the groups is not statistically significant. A p-value comprised between 0.05 and 0.10 indicates that the observed difference is weakly significant at the 10% critical level. Observed differences between two groups are considered to be strongly significant when the p-value is comprised between 0 and 0.05. Stars help indicating whether differences are statistically significant at the 1% (three stars), 5% (two stars) and 10% (one star) critical level. Every second row indicates the number of groups (clusters) considered, and the standard errors of the variables under scrutiny.

Due to the random allocation of VOI in different phases of the program, phase 1 and phase 3 VOI are expected to have on average similar characteristics. According to the results of the balance tests between these two groups (Section A of Appendix 1), most of household characteristics are on average similar between phase 1 and phase 3 VOI. However, the existence of a few differences prevents us from a simple comparison of outcomes at midline. To address this concern, the variables differing at baseline will be included in the estimation of the SLEM program impact.

Despite the attempt of identifying outside comparison Fokontany as similar as possible to Fokontany of phase 1 VOI, the results of the balance tests between the groups reveal some notable differences. The

[22] The p-value represents the probability to obtain the observed difference between the two groups being compared while the two groups would be identical, when randomly sampling a large number of samples from the population of interest.

identification of variables differing between these two groups will guide the matching procedure to be applied in the estimation of the impacts of the SLEM program at endline.

The main finding of the balance tests between households of phase 1 VOI and phase 3 VOI is that in general there are few strongly significant differences. More specifically, regarding socio-demographic characteristics, we do not observe neither large nor significant differences. The only significant variables were related to the reasons of not having toilet access. The questionnaire includes information on households' livelihoods. We observe strongly significant differences for some types of livestock (ducks and animal storage), forest products (coffee and leaves for ripening fruits). When households are asked about the strategies implemented to reduce sensitivity to climate-related hazards, there is a significant difference for using rice when there is a drought during the off-season and for applying pest management when there is a hail, both of 10 percentage points. Among the top 3 strategies used by households, we find significant differences for multi-cropping system, and improvement or creation of grain storage, also of around 10 percentage points. For livestock, we observe a large difference for using animal production when there is a frost, of 30 percentage points. For forest and tree products, there is a significant difference for reducing the forest degradation when there is a drought of 10 percentage points. Regarding the severity of shocks, we find some significant differences concerning the changes that have negatively and severely affected livelihoods in the last 12 months (e.g. flood intensity) and household domestic consumption for fruit.

On the contrary, we observe more differences between households of phase 1 VOI and the comparison group, with households in the comparison group appearing as more vulnerable on average than households of phase 1 VOI. Regarding socio-demographic characteristics, the average difference between the two groups is strongly significant for household distances from Fokontany center and closest forest, with a difference of 20 minutes on average. Differences in marital status are noticeable, of around 10 percentage points. Regarding education achievement, we find strongly significant differences regarding the head of household education and respondents' literacy level, with a greater achievement on average for households of phase 1 VOI.

Sources of livelihood vary across both groups. We find strongly significant differences for cassava and sweet potatoes, of around 20 percentage points. There are differences in terms of production, consumption and storage of some crops, livestock and tree products, with households of phase 1 VOI displaying larger values. Regarding the main strategies used to reduce sensitivity to climate-related hazard, for crops, we observe significant differences for storage (10 percentage points), multi-cropping system and integration of a pest management system (20 percentage points). For livestock, we only find a significant difference for fish farming (11 percentage points). For forest and tree products, there are strongly significant differences for reducing forest degradation (28 percentage points), diversification of livelihoods (20 percentage points) and improving market products. Regarding barriers to the adoption of these strategies, for crops, there is a significant difference in reporting "lack of knowledge" as the barrier for not using agroforestry and tree planting of almost 20 percentage points. Differences also arise in reported damages caused by climate-related hazards on crops (e.g. droughts and frost) and on forest and tree products (e.g. cyclones). Regarding the severity of shocks, we find significant differences concerning the changes that have negatively and severely affected livelihoods in the last 12 months (e.g. access to inputs and unpredictable rainfalls) and household domestic consumption for fruit.

Regarding household consumption and expenditure, households in the control group having eaten more orange vegetable than households of phase 1 VOI. Concerning consumption, there are strongly significant differences for fish and meat, sugar and tea. For expenditure, there is a significant difference for agriculture inputs. When there is a food shortage, the livelihood-based coping strategy which differs between the two group is reducing meal quantities.

Another interesting difference which is worth mentioning is the understanding of climate change between the two groups. There are significant differences between the full understanding of what is climate change and the fact that nature can help to adapt climate change, households of phase 1 VOI having a better understanding of both on average. Finally, there are also large and significant differences regarding the causes and levels of deforestation and the opinions related to the management of protected areas. For the main causes of deforestation, there are more people in phase 1 VOI that think that deforestation is caused by shifting cultivation and natural hazards and fewer people that think that it is caused by cropping. For the satisfaction level, more people in the control group are not at all satisfied (difference of 27 percentage points). Also, there are more people in phase 1 VOI who perceive doing illegal activity as something that is never acceptable. Regarding the opinion towards the management of protected areas by the VOI, more people in phase 1 VOI have reported a violation of the rules to the VOI or authorities.

These results and additional discussion are available in Appendix 1.

IX. CONCLUSIONS AND EXPECTATIONS

a. Indicators for Monitoring and Evaluation of the project

1. Number of crops, animal and forest/tree products used by the household

Agriculture is far more important than livestock/domestic animal production, as well as than the collection of forest and tree products. The most important crops are rice, cassava and sweet potatoes, with rice being more important in CAZ than in COFAV and the opposite for cassava. Chicken herding is the second most important livelihood activity in CAZ, whereas cattle herding is the second most important activity in COFAV. Only a very low percentage of households that we interviewed consider forest and tree products important for their livelihoods, with the most important products being honey and fruits. Cassava is more important as a secondary crop in the target group than the control group. In contrast, sweet potato is more important as a secondary crop in the control than in the treated group.

With the project implementation, we expect a more even distribution of percentage of use of different livelihood sources (i.e. crops, domestic animals) among the targeted farmers. This could mean that other crops will be considered as important as rice and cassava for the household's food security and livelihood, and that there will be changes in households' top priorities for crops, animals and forest products. At the same time, we also expect that the differences in the number of crops and domestic animals/livestock used by households between control and target groups to increase. We expect to see among the farmers' top crops those provided by the project. For example, since the project will provide corn or beans for households, we expect an increase in its importance for livelihoods while at baseline corn is considered top 2 by only 4 % of households in CAZ and 9% in COFAV. At midline and end line, we will expect to have an increase of this value, and this number to differ between control and target groups.

2. Number of farmers who implemented conservation agriculture practices

At least 11% of farmers in CAZ, and 26% in COFAV are using conservation agriculture practices, including the use of agroforestry and tree planting, the use of a multi-cropping systems, soil conservation, pest management, and terracing in both CAZ and COFAV. However, a high percentage of farmers (72% in COFAV and 69% in CAZ) still use strategies to respond to climate-related hazards, such as irrigation and off season rice plantation (27% in COFAV and 55% in CAZ), which may not be sustainable and may not help farmers to adapt in the long run. We expect to see an increase in the number of farmers implementing conservation agriculture practices in their farms by the end of the project, as this is expected to make farmers more resilient to climate change in the long-term, and that this number differs significantly between the control and target groups.

3. Damages in agricultural, forest and livestock product following climate hazards

Farmers reported losses of around one quarter of their top crops (rice and cassava) because of climate-related hazards. We expect to see a decrease in the damages of crops and of domestic animal/livestock production following climate hazards (if these events occur again before the mid- and end-line surveys) with the implementation of project activities. We also expect the differences in the damages of crops and domestic animals/livestock between control and target groups to increase (with the households in the control group more impacted by climate hazards) as the target groups will have received support to reduce damages in agriculture and livestock production.

4. Share of the agricultural production not for household consumption

The baseline survey showed that most of the rice and the cassava production in both CAZ and COFAV is mainly for household consumption. We expect to see a higher percentage of crop production by target households to be sold or stored by the end of the project (compared to the baseline), as farmers would diversify their livelihoods and have more access to markets as part of the project. We also expect to see higher differences in the percentage of sold and stored crops between the target and control groups, by the end of the project, as the control group may not be able to increase production, selling and/or storage due to lack of resources and support to do so.

5. Quantities produced of main crops, animals, forests/tree products

As most of the crop production is currently being used for household consumption, and as we expect a higher percentage of the crop and domestic animal/livestock production to be sold or stored, we also expect that the production of the main crops and animal/livestock to increase so it can be sufficient to ensure the food security of the household.

6. Improvement in market access

Most of the households targeted for this survey sell part of their products. Only few of them 9% for COFAV and 5% for CAZ do not sell their products. However, for CAZ and COFAV the strategy is different: COFAV's households sold their products mainly in municipalities' markets, and those of CAZ through several ways (little market in the village, collector, cooperative etc..). We expect that these figures will change after the project and see products sold more through collectors or other ways giving them access to the regional, national and international market. We expect to see some statistical difference for these variables compared with the control group at end line and midline.

7. Food security index based on food consumption, food expenditure shares and the number of strategies to cope with a lack of food

Households in the project areas are on average food insecure and we expect improvements as the project is implemented. Households in COFAV have a higher food insecurity compared to those in CAZ. Different than what was found for climate change vulnerability, households led by women do not statistically differ in their food security, compared to those led by men.

The lack of statistical difference in food security across households assigned to the different phases (Phase 1-2), and Phase 3 and Control Group, suggests that the households in the different phases can be statistically compared in further analysis to assess the impact of the project interventions on food security. However, given the significant differences in food security between households assigned to phase 1 and households in the control group, even if at low statistical level ($p<0.1$), it is import to carefully compare changes in food insecurity taking into account potential initial differences.

8. Vulnerability index based on exposure, sensitivity and adaptive capacity of farmers

On average, the households that we interviewed in both landscapes have a climate change vulnerability between moderate and severe. There was no significant difference in vulnerability between the households located in CAZ and COFAV, with households in both landscapes considered, on average, moderately vulnerable. However, households led by men are statically less climate-vulnerable than households led by women, which is expected given that women are often more disadvantaged, tend to farm in small plots and work shorter hours to be able to provide other family needs besides food (Chandra et al. 2017), and tend to have a lower access to agricultural inputs, market, mobile phones, credit and to information and knowledge than men.[23] Likewise, households located inside VOIs are statistically less vulnerable than households located outside VOIs, with the latter more vulnerable than the former. This is also expected as farmers outside VOIs have had less access to resources and capacity opportunities as well as less social capital provided by these groups than the ones inside, making them less vulnerable to climate change at baseline.

We expect the vulnerability of the target farmers in the two landscapes to decrease by the end of the project, as project activities will be implemented to reduce the vulnerability of the target farmers. Likewise, we expect the difference in vulnerability between households led and men and women to decrease, and the differences in vulnerability between the target famers and the control farmers increase with the implementation of project activities.

9. Percentage of reported violations prosecuted by authorities/ Self-reported inappropriate use of forests (part of mitigation activity)

On average, among interviewed households, few of them reported illegal activities to VOI or authority (19% for COFAV and 35% for CAZ). In addition, several households, especially in CAZ, were not satisfied with the protection of the surrounding forests. Through the implementation of this project, we expect improvements in these figures at endline and midline. The information on illegal activities will be also combined with the SMART[24] data base that will highlight the number of illegal activities reported through patrolling activities and will help to improve the effectiveness of law enforcement in CAZ and COFAV. This is another aspect for which we expect to see improvements thanks to the project.

b. Use of baseline information in the project implementation

1. Adaptation component: agricultural activities/ Capacity building / land availability

The results of the household survey show that the project can increase efficiency on improving food security and in reducing vulnerability by addressing the main barriers that hindered the use of certain adaptation strategies related to climate hazards. For instance, lack of knowledge and skills are predominant responses for soil conservation, agroforestry, terracing, resistant crops, and multi-cropping. In contrast, lack of money is predominant for pest management, storage and saving groups. Several project activities already aim to strengthen knowledge and skills of farmers, but we need to take those elements especially into account when developing training materials and capacity building for the households/ associations.

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[23] See Goldstein & Udry 2008, Palacios-Lopez & Goldstein 2015, Partney et al 2018.

[24] SMART is a Conservation software that measures, evaluates and improves the effectiveness of wildlife law enforcement patrols and site-based *conservation* activities.

Climate hazards have several impacts on households' production, especially on crops (e.g. rice) and farmers expressed several priorities for adaptation actions that would help them reduce vulnerabilities. The project activities need to be further tailored to address these needs and to strengthen ongoing adaptation measures, such as crops resistant to flooding, soil conservation measures, and disease and pest management plans.

Developing market access is key for decreasing the vulnerability and food insecurity of smallholder farmers in CAZ and COFAV. However, for market's development, the project needs to take into account the constraints as highlighted by the respondents, such as bad road, limited production conditions, or lack of buyers, prices volatility, and general mistrust (e.g. in police controls, weighting products). It is important that the project develops strategies for ensuring that improved products can reach the markets. Developing value chains is key and will help to get higher prices for households' products. In other words, we need to link communities directly to market (e.g. through approaching firms that can buy small farmers' products, or through collectors).

The yearly expenses of households were highlighted in this report, in the amount of about 4,012,096 MGA (1,116 USD) for CAZ and, for COFAV it is estimated on average to reach 3,258,593 MGA (912 USD). If the project do not provide households with benefits that support such expenditures each year or if they do not increase their income, according to the present study, their strategy to cope with a lack of money will be first reducing meals, spend their saving, harvest immature crops, sell last female animal, beg and lastly sell their land. All these strategies can provide benefits in the short-term but will result in increasing vulnerability in the longer term. Therefore, it is important to address the root causes of these behaviours and provide alternative adaptation strategies.

2. Adaptation and communication component Climate hazards

Climate hazards need to be better communicated to households in both CAZ and COFAV. Only 20% of households interviewed at baseline have a good knowledge of climate change and environment. The project aims to increase the capacity of beneficiaries on climate change and the environment.

In terms of communication, a way highlighted by this report is doing communication using families and friends. It seems that if we want to vehicle a message to households and VOI, and be able to see change in behavior, we need to use this mean of communication in priority because, the other way of communication such as radio or phone, are not own by everyone. This could be done by strengthening the information sharing within existing groups in the communities, such as VOI and farmers or women associations.

3. Mitigation component activities

A VOI is still seen as an important organization for managing forest. However, people are afraid to report any illegal activities to VOI or authorities. The project needs to find a way to ensure that illegal activities are reported and sanctioned, and to ensure that the patrolling activities are effective. If we do not address them then the deforestation and degradation will still occur and will have an impact on forest cover in these two landscapes.

4. Training and capacity building for farmers and stakeholders in the project component

This project needs to put in place a strong capacity-building plan and monitoring system to support the smallholder farmers to adopt more efficient practices.

5. Monitoring and evaluation component

We need to put in place a strong monitoring and evaluation system to follow the beneficiaries of this project. This report shows that households' membership is not very clear for some of the respondents, something that needs to be clarified during the process. Additionally, some households that are members of VOI might also be a member of women association. It could be a problem because if a household is member of the VOI and member of a women association, he could be receiving benefits twice and the project would like to avoid this, because it might cause an internal conflict in villages. This means that we need to follow this carefully using beneficiary cards and consider this in any activity of monitoring and in any stage of implementation.

APPENDIXES

a. Appendix 1: Balance tests tables

1. Balance tests between VOIs in phase 1 and phase 3

When comparing socio-demographic characteristics between households of phase 1 VOI and those of phase 3 VOI, we observe a higher percentage of married men heading a household in phase 3 VOI (88%) than in phase 1 VOI (84%) and a higher percentage of married women heading a household in phase 1 VOI (0.03%) than in phase 3 VOI (0.01%). However, these differences are only weakly significant (Appendix table 1). While access to toilet does not differ between the two groups, reasons for not having toilets at home are statistically significant (Appendix table 4).

When comparing the main sources of livelihood/income during the wet season and dry season between households of phase 1 and those in phase 3, we observe a higher percentage of households collecting fruit and plants , 17.5% for phase 1 and 4.7% for phase 3 for wet season and 18.8% for phase 1 and 3.9% for phase 3 for dry season, these differences being strongly significant (Appendix table 5 and 6). A difference also arises for tertiary sources of livelihood classified in “others” category for wet and dry season. However, the difference is small and weakly significant (Appendix table 5 and 6).

When comparing the three most important crops/ livestock/ forest products that improve livelihood/ food security for households in CAZ and COFAV, we observe some differences regarding the three most important crops grown by the households, specifically, for “crop 1 category others” and “crop 2 category others”. However, the average difference is small, and the statistical significance is strong “for crop 1 others”, but weak for “crop 2 others” (Appendix table 7). For “livestock 3 ducks” we observe a substantial difference between phase 3 and phase 1 (10.2% for phase 3 and 20.4% for phase 1) that is statistically significant (Appendix table 8). For “forest product 2” we observe some difference (1.6% for phase 3, and 11% for phase 1) which are strongly significant for “coffee”. For “forest product 2” we observe a strong statistical significance for “leaves for ripening fruits” even if its magnitude is rather low.

When comparing the total production of the three important crops, livestock or animals and forest and tree products, we observe that the difference between the VOI phase 1 and VOI phase 3 for “crop 2 selling” is weak and the average difference is weakly statistically significant (Appendix table 10). The same applies for “animal 2 selling”, but the average difference is strongly statistically significant for “animal 3 storage” (Appendix table 11).

Regarding changes that have negatively impacted household livelihoods in the last 12 months, we observe that “flood intensity” varies substantially between the two groups (48.7% for VOI phase 3 and 60.2 % for VOI phase 1) and the average difference is statistically strong (Appendix table 14). The difference is small for “more unpredictable rainfall” and statistically weak (Appendix table 16). We find the same trend for the variable “hail frequency top 3” (Appendix table 17). We also observe that there is a strong significant difference between phase 3 VOI and phase 1 VOI for land that is less productive. However, the difference is weak (Appendix table 18).

After comparing the impacts of climate related hazards in households for phase 3 VOI and phase 1 VOI, we observed that the average for "flood times" differs barely and its statistical significance is weak (Appendix table 19). The frequency of respondents that reported hail severity "medium "differs for phase 1 and phase 3 (36.6% phase 3 and 25.3% phase 1), this difference being statistically weakly significant (Appendix table 20).

Damages to crop harvest caused by climate-related hazards was revealed to be, on average, slightly different when comparing phase 3 to phase 1 for the following variables : "damage cyclone for crop 2", "damage flood for crop 2", and "damage flood for crop 3". The statistical significance of these difference is weak (Appendix table 25).

When comparing the strategies used to reduce sensitivity to specific climate-related hazards for crops, for phase 1 VOI and phase 3 VOI, we observe a small difference for responses related to resistant crops, multi crops, and pest management, strongly significant for pest management and multi-cropping compared with resistance crops (Appendix table 29). We find also a difference in values for phase 1 and phase 3 for the variable "agroforestry due to frost hazard" (Appendix table 30), the average value for phase 3 being higher than for phase 1 (40%, and 16.8% respectively), though this difference is weakly significant. A small difference was also observed for responses related to resistant crops due to drought, also weakly significant (Appendix table 31). Some differences are noticeable for responses related to the strategy "off-season rice due to drought", "pest management due to hail", "pest management due to frost". This difference is strong for responses pest management when facing "Hail hazards" and, it is strongly significant (Appendix table 32). A substantial difference is observed for the top three strategies used to reduce sensitivity to climate related hazards, multi-cropping system, classified by respondents as top 1 and top 2 and the average difference is statistically strongly significant (Appendix table 33). Average value for improvement/creation of grain storage, classified top 2 by respondents is also shown to differ between groups, though this difference is strongly significant (Appendix table 34).

Related to the main barriers for not using the strategies to reduce sensitivity to climate related hazards for crops, the difference between phase 3 and phase 1 varies substantially for "agroforestry & tree planting: others" and for respondents that said that lack of knowledge and skills are the main barriers to the strategy "contour plowing[25]/terracing", the statistical significance being strong for these two variables (Appendix table 35).

When comparing the strategies used to reduce sensitivity to specific climate-related hazards for livestock between phase 1 and phase 3 VOI, we observe a large difference for responses for strategies related to animal production due to drought and responses for strategies related to fish farming due to frost. There is also a large difference for responses to strategy animal production due to frost. The statistical significance is weak for animal production facing drought, and fish farming facing frost, and strong for animal production facing frost (Appendix table 38)

[25] Contour plowing is the act of farming on a hill or a contoured area. The plows follow the contours of the land horizontally helping to reduce runoff of water. This practice helps to prevent soil erosion in hilly and contoured areas by capturing the water runoff using water breaks to keep water contained.

When comparing the strategies used to reduce sensitivity to specific climate related hazards for forest and tree products, we observe a small difference on average, though strongly significant (Appendix table 41).

When comparing the top three strategies used to reduce sensitivity to specific climate related hazards for forest products between phase 1 and phase 3 VOI, a small difference is observed for responses related to reducing forest degradation, classified as top 3 by respondents, this difference being weakly significant (Appendix table 42).

Related to the main barriers for not using strategies to reduce sensitivity to climate-related hazards for forest products, we observe a small difference for "diversification of livelihoods: lack of technology/tool", however for "diversification of livelihood: lack of time" the difference is substantial. The difference for "diversification of livelihoods: lack of technology and tools" is weakly significant, but strong for "diversification of livelihoods: lack of time" (Appendix table 43).

Regarding the number of days in the last 30 days that the household members eat food, a difference was observed for "cereals" but of small magnitude and only weakly significant (Appendix table 44).

When we compared phase 1 to phase 3, regarding the monetary value of food items for domestic consumption, with and without purchases, in the last 30 days, there is a small difference for cereals obtained by credit, pulses obtained by cash and fruit by cash (Appendix table 45). A substantial difference is observed for fruit obtained by cash (Appendix table 45). A small difference was also observed for sugar obtained without purchasing, being weakly significant (Appendix table 46).

We observe that expenditure related to transport differ substantially when comparing the phase 1 and phase 3, though this difference is weakly significant (Appendix table 47).

Related to food shortage in the last 30 days, we observe that there is a large and strongly significant difference for "change of seed variety coping strategy" (Appendix table 48), and a small and weakly significant difference for "sold last female animal of last seeds strategy" (Appendix table 49).

When we compare the responses of VOI in phase 3 and VOI phase 1 regarding changes in forested areas in the last five years, a small difference arises for respondents that said that it greatly and slightly decreased, this difference being strongly significant (Appendix table 52). When we ask about satisfaction level, there was a small and weakly significant difference between responses between phase 1 and phase 3 that said that they are not at all satisfied (Appendix table 53).

When we talk about information related to markets and organization membership, we observe a small difference between VOI phase 1 and phase 3 regarding households responding, "source of information: other", this difference being weakly significant (Appendix table 56).

For assets and ownerships, a small and weakly significant difference between phase 1 and phase 3 is observed between households that have a motor pump.

Appendix table 1:Socio-demographic characteristics of household members (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Household distances from Fokontany centre (min)	910	45.311	892	45.434	0.990
	[50]	[6.336]	[50]	[7.119]	
Household distance from closest forest (min)	910	68.790	892	61.606	0.387
	[50]	[5.608]	[50]	[6.134]	
Ethnic group: Betsileo (%)	910	0.315	892	0.344	0.822
	[50]	[0.088]	[50]	[0.095]	
Ethnic group: Betsimisaraka (%)	910	0.126	892	0.136	0.866
	[50]	[0.042]	[50]	[0.043]	
Ethnic group: Tanala (%)	910	0.222	892	0.225	0.977
	[50]	[0.069]	[50]	[0.064]	
Ethnic group: Others (%)	910	0.337	892	0.295	0.706
	[50]	[0.088]	[50]	[0.068]	
Year of birth	908	1974.628	894	1974.888	0.846
	[50]	[1.062]	[50]	[0.813]	
Male headed, with a wife/wives (%)	910	0.884	894	0.837	0.067*
	[50]	[0.013]	[50]	[0.021]	
Male headed, divorced, single or widowed (%)	910	0.041	894	0.040	0.926
	[50]	[0.007]	[50]	[0.008]	
Female headed, divorced, single or widowed (%)	910	0.063	894	0.089	0.196
	[50]	[0.010]	[50]	[0.017]	
Female headed, husband away, wife makes most HH/agricultural decision (%)	910	0.012	894	0.034	0.077*
	[50]	[0.006]	[50]	[0.011]	
Total members in the HH	910	6.482	894	6.276	0.521
	[50]	[0.278]	[50]	[0.161]	
Eldest in HH	910	0.292	894	0.299	0.851
	[50]	[0.033]	[50]	[0.021]	
Adults in HH	910	2.546	894	2.565	0.834
	[50]	[0.049]	[50]	[0.072]	
Youth in HH	910	1.249	894	1.179	0.421
	[50]	[0.063]	[50]	[0.061]	
Children in HH	910	1.313	894	1.246	0.393
	[50]	[0.066]	[50]	[0.044]	
Children <5 in HH	910	1.081	894	0.988	0.494
	[50]	[0.117]	[50]	[0.070]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 2. Socio-demographic characteristics of household members (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Children attending school	910	1.022	894	1.032	0.859
	[50]	[0.045]	[50]	[0.036]	
HH respondent: Has never gone to school (%)	910	0.195	894	0.165	0.513
	[50]	[0.039]	[50]	[0.023]	
HH respondent: Elementary school (%)	910	0.637	894	0.649	0.771
	[50]	[0.034]	[50]	[0.019]	
HH respondent: Lower/Junior High School (%)	910	0.138	894	0.158	0.428
	[50]	[0.019]	[50]	[0.017]	
HH respondent: Higher/Senior High School (%)	910	0.028	894	0.024	0.663
	[50]	[0.007]	[50]	[0.006]	
HoH[26]: Elementary school (%)	162	0.687	280	0.686	0.985
	[34]	[0.055]	[36]	[0.037]	
HoH: Lower/Junior High School (%)	162	0.110	280	0.171	0.188
	[34]	[0.036]	[36]	[0.030]	
HoH: Higher/Senior High School (%)	162	0.053	280	0.027	0.175
	[34]	[0.015]	[36]	[0.012]	
HoH: Technical Training (%)	162	0.004	280	0.002	0.647
	[34]	[0.004]	[36]	[0.002]	
Literacy: No (%)	910	0.299	894	0.269	0.463
	[50]	[0.029]	[50]	[0.029]	
Literacy: Yes, Malagasy (%)	910	0.557	894	0.550	0.860
	[50]	[0.025]	[50]	[0.030]	
Literacy: Yes, Malagasy and French (%)	910	0.133	894	0.165	0.182
	[50]	[0.013]	[50]	[0.019]	
Literacy: Others (%)	910	0.011	894	0.016	0.505
	[50]	[0.004]	[50]	[0.007]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

[26] HoH: Head of the household

Appendix table 3. Socio-demographic characteristics of household members (in %) (part 3)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
House: Own	910	0.941	894	0.923	0.300
	[50]	[0.011]	[50]	[0.014]	
House: Rented	910	0.003	894	0.002	0.829
	[50]	[0.002]	[50]	[0.001]	
House: Borrowed/Family	910	0.051	894	0.069	0.270
	[50]	[0.010]	[50]	[0.013]	
House: Other	910	0.005	894	0.006	0.863
	[50]	[0.003]	[50]	[0.003]	
Years living in the village	910	18.117	892	17.949	0.927
	[50]	[1.560]	[50]	[0.971]	
Move from: Same Village	910	0.522	893	0.543	0.634
	[50]	[0.028]	[50]	[0.033]	
Move from: Village in same FOKONTANY	910	0.336	893	0.288	0.307
	[50]	[0.027]	[50]	[0.039]	
Move from: Village in same COMMUNE	910	0.076	893	0.070	0.719
	[50]	[0.014]	[50]	[0.012]	
Move from: Village in same PROVINCE	910	0.047	893	0.071	0.132
	[50]	[0.008]	[50]	[0.014]	
Move from: Village in OTHER PROVINCE	910	0.019	893	0.029	0.298
	[50]	[0.006]	[50]	[0.008]	
Reason: Work opportunity	509	0.314	490	0.240	0.329
	[50]	[0.069]	[50]	[0.031]	
Reason: Lack of land	509	0.193	490	0.157	0.373
	[50]	[0.032]	[50]	[0.025]	
Reason: Family (wife/husband)	509	0.444	490	0.515	0.390
	[50]	[0.066]	[50]	[0.049]	
Reason: Social conflicts or violence	509	0.013	490	0.030	0.248
	[50]	[0.007]	[50]	[0.013]	
Reason: Climate/Natural hazards	509	0.010	490	0.021	0.217
	[50]	[0.006]	[50]	[0.007]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 4.Dwelling characteristics (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Roof: Medium value added	910	0.064	894	0.139	0.214
	[50]	[0.020]	[50]	[0.056]	
Roof: High value added	910	0.228	894	0.250	0.606
	[50]	[0.034]	[50]	[0.029]	
Wall: Medium value added	910	0.531	894	0.632	0.138
	[50]	[0.058]	[50]	[0.035]	
Wall: High value added	910	0.044	894	0.047	0.844
	[50]	[0.012]	[50]	[0.010]	
Floor: Little value added	910	0.805	894	0.727	0.165
	[50]	[0.039]	[50]	[0.040]	
Floor: Medium value added	910	0.112	894	0.173	0.178
	[50]	[0.026]	[50]	[0.038]	
Floor: High value added	910	0.084	894	0.100	0.643
	[50]	[0.028]	[50]	[0.020]	
Electricity access	910	0.210	894	0.254	0.421
	[50]	[0.035]	[50]	[0.041]	
Water access	910	0.374	894	0.496	0.162
	[50]	[0.061]	[50]	[0.062]	
Toilet access	910	0.514	894	0.542	0.747
	[50]	[0.075]	[50]	[0.046]	
Reason no toilet: Lack of money	348	0.017	354	0.089	0.019**
	[39]	[0.012]	[41]	[0.028]	
Reason no toilet: Not interested	348	0.375	354	0.187	0.023**
	[39]	[0.073]	[41]	[0.037]	
Reason no toilet: Not used to	348	0.131	354	0.182	0.537
	[39]	[0.065]	[41]	[0.051]	
Reason no toilet: Out of use	348	0.108	354	0.206	0.036**
	[39]	[0.032]	[41]	[0.034]	
Reason no toilet: Will build later	348	0.320	354	0.253	0.233
	[39]	[0.047]	[41]	[0.032]	
Reason no toilet: Other	348	0.050	354	0.084	0.294
	[39]	[0.017]	[41]	[0.028]	
Cooking with fuelwood	910	0.993	890	0.991	0.679

	[50]	[0.003]	[50]	[0.004]	
Cooking with charcoal	910	0.020	890	0.032	0.357
	[50]	[0.007]	[50]	[0.011]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 5. Main sources of livelihood/income during the wet season (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Primary source of livelihood: Cultivation	910	0.970	894	0.955	0.316
	[50]	[0.008]	[50]	[0.012]	
Primary source of livelihood: Others	910	0.030	894	0.045	0.316
	[50]	[0.008]	[50]	[0.012]	
Secondary source of livelihood: Herding	827	0.840	821	0.843	0.925
	[50]	[0.023]	[50]	[0.029]	
Secondary source of livelihood: Daily worker	827	0.073	821	0.073	0.978
	[50]	[0.014]	[50]	[0.017]	
Secondary source of livelihood: Others	827	0.088	821	0.084	0.878
	[50]	[0.020]	[50]	[0.017]	
Tertiary source of livelihood: Herding	237	0.162	306	0.141	0.629
	[45]	[0.034]	[44]	[0.027]	
Tertiary source of livelihood: Fishing	237	0.020	306	0.037	0.390
	[45]	[0.010]	[44]	[0.016]	
Tertiary source of livelihood: Collecting fruits/plants	237	0.047	306	0.175	0.039**
	[45]	[0.017]	[44]	[0.059]	
Tertiary source of livelihood: Handcrafter	237	0.078	306	0.112	0.527
	[45]	[0.024]	[44]	[0.049]	
Tertiary source of livelihood: Merchant	237	0.110	306	0.100	0.776
	[45]	[0.028]	[44]	[0.024]	
Tertiary source of livelihood: Daily worker	237	0.277	306	0.226	0.431
	[45]	[0.047]	[44]	[0.045]	
Tertiary source of livelihood: Others	237	0.305	306	0.209	0.059*
	[45]	[0.034]	[44]	[0.037]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 6. Main sources of livelihood/income during the dry season (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Primary source of livelihood: Cultivation	910	0.945	894	0.953	0.632
	[50]	[0.013]	[50]	[0.011]	
Primary source of livelihood: Others	910	0.055	894	0.047	0.632
	[50]	[0.013]	[50]	[0.011]	
Secondary source of livelihood: Herding	808	0.851	811	0.849	0.961
	[50]	[0.023]	[50]	[0.028]	
Secondary source of livelihood: Daily worker	808	0.045	811	0.054	0.580
	[50]	[0.009]	[50]	[0.014]	
Secondary source of livelihood: Others	808	0.104	811	0.097	0.799
	[50]	[0.021]	[50]	[0.020]	
Tertiary source of livelihood: Herding	235	0.175	295	0.124	0.285
	[43]	[0.037]	[44]	[0.030]	
Tertiary source of livelihood: Fishing	235	0.018	295	0.041	0.194
	[43]	[0.009]	[44]	[0.015]	
Tertiary source of livelihood: Collecting fruits/plants	235	0.039	295	0.188	0.018**
	[43]	[0.015]	[44]	[0.060]	
Tertiary source of livelihood: Handcrafter	235	0.085	295	0.100	0.774
	[43]	[0.028]	[44]	[0.043]	
Tertiary source of livelihood: Merchant	235	0.125	295	0.098	0.562
	[43]	[0.038]	[44]	[0.027]	
Tertiary source of livelihood: Daily worker	235	0.237	295	0.227	0.879
	[43]	[0.047]	[44]	[0.041]	
Tertiary source of livelihood: Others	235	0.322	295	0.222	0.082*
	[43]	[0.044]	[44]	[0.037]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 7. The three most important crop grown by the household (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Crop 1: Cassava	904	0.071	887	0.089	0.570
	[50]	[0.024]	[50]	[0.020]	
Crop 1: Rice	904	0.916	887	0.869	0.171
	[50]	[0.026]	[50]	[0.023]	
Crop 1: Others	904	0.012	887	0.042	0.020**
	[50]	[0.006]	[50]	[0.011]	
Crop 2: Cassava	891	0.645	880	0.586	0.448
	[50]	[0.057]	[50]	[0.053]	
Crop 2: Rice	891	0.065	880	0.079	0.627
	[50]	[0.022]	[50]	[0.019]	
Crop 2: Maize	891	0.057	880	0.105	0.324
	[50]	[0.022]	[50]	[0.043]	
Crop 2: Beans	891	0.103	880	0.082	0.575
	[50]	[0.032]	[50]	[0.022]	
Crop 2: Sweet potatoes	891	0.075	880	0.050	0.489
	[50]	[0.033]	[50]	[0.017]	
Crop 2: Others	891	0.055	880	0.099	0.095*
	[50]	[0.013]	[50]	[0.023]	
Crop 3: Cassava	769	0.133	743	0.151	0.656
	[50]	[0.029]	[50]	[0.028]	
Crop 3: Maize	769	0.114	743	0.099	0.687
	[50]	[0.030]	[50]	[0.021]	
Crop 3: Bananas	769	0.226	743	0.181	0.518
	[50]	[0.062]	[50]	[0.035]	
Crop 3: Beans	769	0.099	743	0.116	0.632
	[50]	[0.025]	[50]	[0.027]	
Crop 3: Sugarcane	769	0.036	743	0.055	0.297
	[50]	[0.011]	[50]	[0.015]	
Crop 3: Sweet potatoes	769	0.268	743	0.258	0.873
	[50]	[0.044]	[50]	[0.039]	
Crop 3: Taro	769	0.054	743	0.045	0.634
	[50]	[0.016]	[50]	[0.010]	
Crop 3: Others	769	0.071	743	0.096	0.256
	[50]	[0.012]	[50]	[0.018]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 8. The three most important livestock/domestic animals (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Livestock 1: Cattle	801	0.434	794	0.370	0.411
	[49]	[0.047]	[50]	[0.062]	
Livestock 1: Pigs	801	0.123	794	0.118	0.899
	[49]	[0.030]	[50]	[0.024]	
Livestock 1: Chicken	801	0.419	794	0.485	0.354
	[49]	[0.047]	[50]	[0.055]	
Livestock 1: Others	801	0.024	794	0.026	0.861
	[49]	[0.008]	[50]	[0.007]	
Livestock 2: Cattle	543	0.050	511	0.058	0.675
	[48]	[0.010]	[50]	[0.016]	
Livestock 2: Pigs	543	0.305	511	0.274	0.679
	[48]	[0.047]	[50]	[0.057]	
Livestock 2: Chicken	543	0.453	511	0.467	0.848
	[48]	[0.044]	[50]	[0.060]	
Livestock 2: Ducks	543	0.076	511	0.078	0.957
	[48]	[0.015]	[50]	[0.021]	
Livestock 2: Goos	543	0.048	511	0.033	0.387
	[48]	[0.014]	[50]	[0.012]	
Livestock 2: Dokotra	543	0.044	511	0.050	0.727
	[48]	[0.010]	[50]	[0.013]	
Livestock 2: Others	543	0.024	511	0.041	0.218
	[48]	[0.007]	[50]	[0.012]	
Livestock 3: Cattle	279	0.037	214	0.043	0.798
	[46]	[0.018]	[46]	[0.015]	
Livestock 3: Pigs	279	0.106	214	0.096	0.813
	[46]	[0.032]	[46]	[0.025]	
Livestock 3: Chicken	279	0.469	214	0.432	0.754
	[46]	[0.066]	[46]	[0.097]	
Livestock 3: Ducks	279	0.102	214	0.204	0.016**
	[46]	[0.017]	[46]	[0.038]	
Livestock 3: Goos	279	0.055	214	0.021	0.115
	[46]	[0.019]	[46]	[0.010]	
Livestock 3: Dokotra	279	0.198	214	0.123	0.385
	[46]	[0.075]	[46]	[0.043]	
Livestock 3: Others	279	0.033	214	0.081	0.169
	[46]	[0.011]	[46]	[0.033]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 9. The three most important forest and tree products (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Forest & Tree Product 1: Timber	753	0.188	720	0.175	0.751
	[49]	[0.032]	[49]	[0.025]	
Forest & Tree Product 1: Firewood	753	0.500	720	0.536	0.673
	[49]	[0.065]	[49]	[0.052]	
Forest & Tree Product 1: Leaves for medicines	753	0.216	720	0.213	0.978
	[49]	[0.084]	[49]	[0.052]	
Forest & Tree Product 1: Others	753	0.096	720	0.076	0.591
	[49]	[0.032]	[49]	[0.018]	
Forest & Tree Product 2: Timber	411	0.293	367	0.267	0.739
	[46]	[0.067]	[43]	[0.040]	
Forest & Tree Product 2: Firewood	411	0.476	367	0.358	0.217
	[46]	[0.083]	[43]	[0.047]	
Forest & Tree Product 2: Leaves for medicines	411	0.093	367	0.111	0.579
	[46]	[0.020]	[43]	[0.027]	
Forest & Tree Product 2: Coffee	411	0.016	367	0.110	0.001***
	[46]	[0.008]	[43]	[0.025]	
Forest & Tree Product 2: Others	411	0.121	367	0.153	0.535
	[46]	[0.040]	[43]	[0.033]	
Forest & Tree Product 3: Timber	120	0.175	130	0.099	0.317
	[30]	[0.071]	[30]	[0.028]	
Forest & Tree Product 3: Firewood	120	0.235	130	0.233	0.990
	[30]	[0.075]	[30]	[0.055]	
Forest & Tree Product 3: Leaves for medicines	120	0.115	130	0.116	0.986
	[30]	[0.040]	[30]	[0.050]	
Forest & Tree Product 3: Leaves for ripening fruits	120	0.012	130	0.080	0.035**
	[30]	[0.009]	[30]	[0.030]	
Forest & Tree Product 3: Coffee	120	0.117	130	0.319	0.061*
	[30]	[0.058]	[30]	[0.090]	
Forest & Tree Product 3: wild roots	120	0.210	130	0.084	0.099*
	[30]	[0.069]	[30]	[0.031]	
Forest & Tree Product 3: Others	120	0.136	130	0.070	0.240
	[30]	[0.045]	[30]	[0.034]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 10. Total production and use of the three most important crops (in kg)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Crop 1 production	903	814.867	887	814.408	0.997
	[50]	[92.967]	[50]	[51.817]	
Crop 1 consumption	903	524.930	887	597.587	0.117
	[50]	[29.624]	[50]	[35.478]	
Crop 1 selling	903	238.612	887	164.810	0.345
	[50]	[75.075]	[50]	[21.624]	
Crop 1 storage	903	49.281	886	49.143	0.993
	[50]	[10.009]	[50]	[11.176]	
Crop 2 production	884	648.679	873	1183.769	0.193
	[50]	[72.975]	[50]	[403.799]	
Crop 2 consumption	884	539.182	873	980.072	0.278
	[50]	[64.292]	[50]	[400.684]	
Crop 2 selling	884	100.236	873	172.504	0.088*
	[50]	[21.028]	[50]	[36.594]	
Crop 2 storage	884	7.528	873	30.978	0.157
	[50]	[1.776]	[50]	[16.424]	
Crop 3 production	765	546.175	729	3720.949	0.272
	[50]	[114.416]	[50]	[2883.261]	
Crop 3 consumption	765	427.469	729	3500.258	0.289
	[50]	[110.812]	[50]	[2896.462]	
Crop 3 selling	765	116.942	729	165.847	0.397
	[50]	[35.410]	[50]	[45.578]	
Crop 3 storage	765	2.296	730	2.702	0.677
	[50]	[0.733]	[50]	[0.644]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 11. Total production and use of the three most important livestock and domestic animals (in kg)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Animal 1 production	806	12.065	787	14.453	0.219
	[49]	[1.273]	[50]	[1.461]	
Animal 1 consumption	806	2.669	787	4.136	0.185
	[49]	[0.432]	[50]	[1.016]	
Animal 1 selling	806	2.578	787	2.676	0.891
	[49]	[0.605]	[50]	[0.378]	
Animal 1 storage	805	5.400	787	6.222	0.200
	[49]	[0.462]	[50]	[0.442]	
Animal 2 production	551	13.900	504	13.032	0.677
	[49]	[1.433]	[50]	[1.514]	
Animal 2 consumption	550	3.936	503	3.557	0.767
	[49]	[0.814]	[50]	[0.995]	
Animal 2 selling	551	3.534	502	2.370	0.081*
	[49]	[0.533]	[50]	[0.394]	
Animal 2 storage	550	5.476	500	5.859	0.665
	[49]	[0.569]	[50]	[0.679]	
Animal 3 production	290	13.607	225	13.908	0.888
	[48]	[1.768]	[46]	[1.219]	
Animal 3 consumption	290	2.835	223	2.628	0.821
	[48]	[0.389]	[46]	[0.830]	
Animal 3 selling	290	3.931	225	3.161	0.505
	[48]	[1.010]	[46]	[0.564]	
Animal 3 storage	289	5.295	224	7.722	0.025**
	[48]	[0.485]	[46]	[0.957]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 12. Total production and use of the three most important forest and tree products (in kg)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Forest 1 production	749	348.184	707	310.499	0.755
	[49]	[96.493]	[48]	[72.647]	
Forest 1 consumption	749	329.125	703	283.098	0.702
	[49]	[97.059]	[49]	[71.287]	
Forest 1 selling	746	17.553	705	45.128	0.189
	[49]	[5.764]	[49]	[20.153]	
Forest 1 storage	746	1.157	703	20.576	0.278
	[49]	[0.526]	[49]	[17.862]	
Forest 2 production	398	228.537	386	464.970	0.297
	[48]	[60.579]	[48]	[218.177]	
Forest 2 consumption	397	213.493	389	270.529	0.494
	[48]	[60.806]	[47]	[57.265]	
Forest 2 selling	394	12.654	387	16.733	0.599
	[48]	[4.311]	[47]	[6.463]	
Forest 2 storage	391	0.924	382	3.831	0.103
	[48]	[0.586]	[47]	[1.676]	
Forest 3 production	123	406.290	147	2738.214	0.326
	[29]	[152.730]	[35]	[2360.688]	
Forest 3 consumption	122	397.529	147	2726.054	0.326
	[29]	[154.913]	[35]	[2357.314]	
Forest 3 selling	122	10.222	147	12.132	0.742
	[29]	[4.013]	[35]	[4.208]	
Forest 3 storage	124	0.115	141	0.312	0.389
	[30]	[0.076]	[35]	[0.215]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 13. Land ownership and food security

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Total land owned (ha)	902	3.012	889	2.514	0.160
	[50]	[0.273]	[50]	[0.224]	
Total land rented (ha)	902	0.039	889	0.086	0.136
	[50]	[0.012]	[50]	[0.029]	
Total land communal (ha)	902	0.422	889	0.331	0.486
	[50]	[0.114]	[50]	[0.063]	
Total land state owned (ha)	902	0.271	889	0.301	0.915
	[50]	[0.217]	[50]	[0.182]	
Food security: Same condition (%)	892	0.182	880	0.155	0.512
	[50]	[0.036]	[50]	[0.021]	
Food security: Better off (%)	892	0.458	880	0.441	0.797
	[50]	[0.058]	[50]	[0.030]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 14. Changes that have negatively impacted households' livelihood in the last 12 months (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Low price crops	910	0.798	894	0.745	0.363
	[50]	[0.036]	[50]	[0.046]	
Low demand crops	910	0.439	894	0.382	0.533
	[50]	[0.078]	[50]	[0.048]	
Access to inputs	910	0.719	894	0.701	0.733
	[50]	[0.042]	[50]	[0.029]	
Access to markets	910	0.496	894	0.534	0.604
	[50]	[0.054]	[50]	[0.049]	
Restrictive rules	910	0.135	893	0.147	0.765
	[50]	[0.030]	[50]	[0.027]	
Unpredictable rainfall	910	0.835	892	0.777	0.181
	[50]	[0.025]	[50]	[0.035]	
Less rainfall	910	0.593	894	0.503	0.156
	[50]	[0.045]	[50]	[0.044]	
Droughts intensity	910	0.616	894	0.526	0.173
	[50]	[0.044]	[50]	[0.049]	
Floods frequency	910	0.508	894	0.586	0.166
	[50]	[0.045]	[50]	[0.034]	
Floods intensity	910	0.487	894	0.602	0.032**
	[50]	[0.041]	[50]	[0.034]	
Wind/cyclones frequency	910	0.488	894	0.553	0.263
	[50]	[0.041]	[50]	[0.040]	
Wind/cyclone intensity	910	0.563	894	0.624	0.331
	[50]	[0.049]	[50]	[0.039]	
Higher temperatures	910	0.543	894	0.465	0.198
	[50]	[0.049]	[50]	[0.036]	
Hail frequency	910	0.318	894	0.377	0.384
	[50]	[0.050]	[50]	[0.046]	
Frost frequency	910	0.238	894	0.309	0.343
	[50]	[0.060]	[50]	[0.043]	
Land less productive	909	0.682	894	0.596	0.183
	[50]	[0.048]	[50]	[0.042]	
Land scarcity	910	0.526	894	0.502	0.626
	[50]	[0.039]	[50]	[0.030]	
Labour too expensive	910	0.656	894	0.657	0.975
	[50]	[0.033]	[50]	[0.033]	
Labour scarcity	910	0.141	894	0.151	0.790
	[50]	[0.027]	[50]	[0.027]	
Plants pests/diseases	908	0.905	892	0.892	0.646
	[50]	[0.018]	[50]	[0.021]	
New plants diseases	910	0.520	894	0.503	0.769
	[50]	[0.034]	[50]	[0.046]	
More human diseases	909	0.513	894	0.592	0.324
	[50]	[0.066]	[50]	[0.045]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 15. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Low price to sell agricultural products: Top 1	661	0.579	643	0.637	0.461
	[50]	[0.068]	[50]	[0.040]	
Low price to sell agricultural products: Top 2	661	0.316	643	0.279	0.565
	[50]	[0.057]	[50]	[0.031]	
Low price to sell agricultural products: Top 3	661	0.104	643	0.083	0.405
	[50]	[0.019]	[50]	[0.017]	
Low demand for agricultural products: Top 1	267	0.121	266	0.132	0.760
	[42]	[0.025]	[44]	[0.027]	
Low demand for agricultural products: Top 2	267	0.570	266	0.507	0.420
	[42]	[0.067]	[44]	[0.042]	
Low demand for agricultural products: Top 3	267	0.309	266	0.361	0.548
	[42]	[0.076]	[44]	[0.041]	
Difficult access to agricultural inputs: Top 1	574	0.395	579	0.383	0.899
	[50]	[0.086]	[50]	[0.047]	
Difficult access to agricultural inputs: Top 2	574	0.292	579	0.302	0.863
	[50]	[0.043]	[50]	[0.032]	
Difficult access to agricultural inputs: Top 3	574	0.313	579	0.316	0.973
	[50]	[0.086]	[50]	[0.039]	
Low market accessibility: Top 1	413	0.279	419	0.237	0.520
	[49]	[0.052]	[47]	[0.038]	
Low market accessibility: Top 2	413	0.310	419	0.374	0.214
	[49]	[0.026]	[47]	[0.045]	
Low market accessibility: Top 3	413	0.412	419	0.389	0.785
	[49]	[0.061]	[47]	[0.057]	
More restrictive rules for land use: Top 1	76	0.249	78	0.221	0.691
	[26]	[0.047]	[27]	[0.052]	
More restrictive rules for land use: Top 2	76	0.351	78	0.390	0.746
	[26]	[0.058]	[27]	[0.104]	
More restrictive rules for land use: Top 3	76	0.400	78	0.389	0.920

	[26]	[0.072]	[27]	[0.083]

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 16. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
More unpredictable rainfall: Top 1	341	0.341	338	0.262	0.194
	[50]	[0.042]	[47]	[0.044]	
More unpredictable rainfall: Top 2	341	0.272	338	0.257	0.756
	[50]	[0.033]	[47]	[0.037]	
More unpredictable rainfall: Top 3	341	0.386	338	0.481	0.063*
	[50]	[0.036]	[47]	[0.036]	
Less overall rainfall: Top 1	316	0.217	251	0.297	0.191
	[47]	[0.048]	[48]	[0.038]	
Less overall rainfall: Top 2	316	0.381	251	0.349	0.456
	[47]	[0.032]	[48]	[0.027]	
Less overall rainfall: Top 3	316	0.403	251	0.354	0.455
	[47]	[0.052]	[48]	[0.039]	
More intense drought: Top 1	420	0.519	371	0.555	0.495
	[50]	[0.037]	[49]	[0.039]	
More intense drought: Top 2	420	0.318	371	0.266	0.194
	[50]	[0.028]	[49]	[0.029]	
More intense drought: Top 3	420	0.163	371	0.179	0.638
	[50]	[0.022]	[49]	[0.024]	
More overall rainfall: Top 1	218	0.383	227	0.357	0.724
	[47]	[0.043]	[45]	[0.060]	
More overall rainfall: Top 2	218	0.363	227	0.329	0.493
	[47]	[0.036]	[45]	[0.034]	
More overall rainfall: Top 3	218	0.254	227	0.314	0.476
	[47]	[0.046]	[45]	[0.071]	
More intense floods: Top 1	280	0.291	333	0.260	0.590
	[46]	[0.042]	[48]	[0.039]	
More intense floods: Top 2	280	0.463	333	0.468	0.935
	[46]	[0.033]	[48]	[0.047]	
More intense floods: Top 3	280	0.246	333	0.272	0.580
	[46]	[0.031]	[48]	[0.035]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 17. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 3)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
More frequent winds: Top 1	251	0.359	271	0.398	0.591
	[46]	[0.056]	[45]	[0.046]	
More frequent winds: Top 2	251	0.380	271	0.360	0.776
	[46]	[0.054]	[45]	[0.045]	
More frequent winds: Top 3	251	0.261	271	0.243	0.758
	[46]	[0.052]	[45]	[0.032]	
More intense winds: Top 1	300	0.403	279	0.348	0.324
	[48]	[0.039]	[47]	[0.039]	
More intense winds: Top 2	300	0.381	279	0.381	0.990
	[48]	[0.029]	[47]	[0.041]	
More intense winds: Top 3	300	0.216	279	0.270	0.355
	[48]	[0.035]	[47]	[0.047]	
Higher temperatures: Top 1	144	0.138	115	0.194	0.442
	[38]	[0.040]	[39]	[0.061]	
Higher temperatures: Top 2	144	0.294	115	0.241	0.422
	[38]	[0.045]	[39]	[0.048]	
Higher temperatures: Top 3	144	0.568	115	0.565	0.968
	[38]	[0.051]	[39]	[0.059]	
More frequent hail: Top 1	200	0.267	169	0.375	0.199
	[40]	[0.035]	[42]	[0.076]	
More frequent hail: Top 2	200	0.285	169	0.309	0.687
	[40]	[0.038]	[42]	[0.047]	
More frequent hail: Top 3	200	0.448	169	0.316	0.067*
	[40]	[0.050]	[42]	[0.051]	
More frequent frost: Top 1	76	0.095	77	0.194	0.160
	[26]	[0.041]	[29]	[0.057]	
More frequent frost: Top 2	76	0.246	77	0.277	0.742
	[26]	[0.060]	[29]	[0.074]	
More frequent frost: Top 3	76	0.659	77	0.528	0.361
	[26]	[0.079]	[29]	[0.120]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 18. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 4)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Land is less productive: Top 1	545	0.908	540	0.829	0.030**
	[50]	[0.015]	[50]	[0.033]	
Land is less productive: Top 2	545	0.092	540	0.171	0.030**
	[50]	[0.015]	[50]	[0.033]	
Land is less productive: Top 3	545	0.000	540	0.000	N/A
	[50]	[0.000]	[50]	[0.000]	
Less productive land available: Top 1	443	0.212	460	0.348	0.015**
	[50]	[0.036]	[50]	[0.041]	
Less productive land available: Top 2	443	0.788	460	0.651	0.013**
	[50]	[0.036]	[50]	[0.041]	
Less productive land available: Top 3	443	0.000	460	0.002	0.321
	[50]	[0.000]	[50]	[0.002]	
Unable to hire labour because expensive: Top 1	587	0.943	542	0.960	0.447
	[50]	[0.017]	[50]	[0.015]	
Unable to hire labour because expensive: Top 2	587	0.052	542	0.040	0.600
	[50]	[0.017]	[50]	[0.015]	
Unable to hire labour because expensive: Top 3	587	0.005	542	0.000	0.155
	[50]	[0.004]	[50]	[0.000]	
Unable to hire labour because unavailable: Top 1	105	0.326	114	0.204	0.276
	[32]	[0.092]	[31]	[0.063]	
Unable to hire labour because unavailable: Top 2	105	0.674	114	0.796	0.276
	[32]	[0.092]	[31]	[0.063]	
More agriculture pests: Top 1	798	0.692	788	0.643	0.438
	[50]	[0.050]	[50]	[0.039]	
More agriculture pests: Top 2	798	0.280	788	0.307	0.646
	[50]	[0.047]	[50]	[0.037]	
More agriculture pests: Top 3	798	0.028	788	0.050	0.160
	[50]	[0.009]	[50]	[0.013]	
New agriculture pests have come: Top 1	429	0.176	450	0.174	0.955
	[49]	[0.032]	[50]	[0.034]	
New agriculture pests have come: Top 2	429	0.604	450	0.581	0.746
	[49]	[0.061]	[50]	[0.040]	
New agriculture pests have come: Top 3	429	0.219	450	0.245	0.721
	[49]	[0.048]	[50]	[0.056]	
More human diseases: Top 1	537	0.444	568	0.476	0.650
	[49]	[0.050]	[50]	[0.051]	
More human diseases: Top 2	537	0.255	568	0.268	0.791

	[49]	[0.030]	[50]	[0.036]	
More human diseases: Top 3	537	0.301	568	0.256	0.574
	[49]	[0.052]	[50]	[0.060]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 19. The impact of climate-related hazards on households (frequency and year)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cyclone times	910	2.222	891	2.538	0.107
	[50]	[0.168]	[50]	[0.101]	
Cyclone latest year	821	2017.736	808	2017.747	0.903
	[50]	[0.068]	[50]	[0.055]	
Drought times	910	1.776	893	1.752	0.913
	[50]	[0.124]	[50]	[0.182]	
Drought latest year	802	2017.393	801	2017.350	0.696
	[50]	[0.059]	[50]	[0.094]	
Flood times	906	1.611	880	1.947	0.060*
	[50]	[0.144]	[50]	[0.104]	
Flood latest year	645	2017.751	663	2017.771	0.728
	[49]	[0.040]	[48]	[0.041]	
Hail times	907	0.858	891	0.968	0.532
	[50]	[0.142]	[50]	[0.104]	
Hail latest year	450	2017.528	480	2017.487	0.770
	[47]	[0.075]	[49]	[0.117]	
Frost times	910	0.827	893	1.018	0.516
	[50]	[0.242]	[50]	[0.167]	
Frost latest year	212	2017.688	289	2017.562	0.296
	[36]	[0.052]	[39]	[0.109]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 20. The impact of climate-related hazards on households (by degree of severity) (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Strong Wind: Severe	788	0.422	776	0.456	0.598
	[50]	[0.050]	[50]	[0.039]	
Strong Wind: Medium	788	0.423	776	0.406	0.730
	[50]	[0.038]	[50]	[0.031]	
Strong Wind: Mild	788	0.155	776	0.139	0.604
	[50]	[0.027]	[50]	[0.017]	
Drought: Severe	735	0.541	719	0.477	0.349
	[50]	[0.057]	[50]	[0.038]	
Drought: Medium	735	0.284	719	0.276	0.859
	[50]	[0.036]	[50]	[0.026]	
Drought: Mild	735	0.176	719	0.247	0.223
	[50]	[0.043]	[50]	[0.040]	
Flood: Severe	525	0.275	561	0.224	0.199
	[49]	[0.031]	[48]	[0.025]	
Flood: Medium	525	0.319	561	0.376	0.172
	[49]	[0.026]	[48]	[0.032]	
Flood: Mild	525	0.405	561	0.399	0.920
	[49]	[0.043]	[48]	[0.041]	
Hail: Severe	264	0.190	224	0.288	0.178
	[44]	[0.034]	[46]	[0.064]	
Hail: Medium	264	0.366	224	0.253	0.051*
	[44]	[0.043]	[46]	[0.038]	
Hail: Mild	264	0.444	224	0.460	0.834
	[44]	[0.049]	[46]	[0.054]	
Frost: Severe	96	0.160	96	0.220	0.561
	[28]	[0.073]	[26]	[0.073]	
Frost: Medium	96	0.304	96	0.363	0.439
	[28]	[0.051]	[26]	[0.057]	
Frost: Mild	96	0.536	96	0.417	0.343
	[28]	[0.108]	[26]	[0.063]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 21. Damages to the dwelling caused by climate-related hazards (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact strong wind on house: Not Damaged	807	0.647	813	0.572	0.168
	[50]	[0.043]	[50]	[0.033]	
Impact strong wind on house: Roof damaged (slightly)	807	0.150	813	0.172	0.430
	[50]	[0.021]	[50]	[0.019]	
Impact strong wind on house: Roof + Walls (Moderately)	807	0.073	813	0.092	0.444
	[50]	[0.015]	[50]	[0.020]	
Impact strong wind on house: Destroyed (Severe)	807	0.085	813	0.092	0.678
	[50]	[0.014]	[50]	[0.012]	
Impact drought on house: Not Damaged	910	0.999	893	0.996	0.167
	[50]	[0.001]	[50]	[0.002]	
Impact drought on house: Roof damaged (slightly)	910	0.000	893	0.002	0.187
	[50]	[0.000]	[50]	[0.001]	
Impact drought on house: Roof + Walls (Moderately)	910	0.000	893	0.000	0.327
	[50]	[0.000]	[50]	[0.000]	
Impact hail on house: Not Damaged	910	0.975	893	0.968	0.637
	[50]	[0.011]	[50]	[0.009]	
Impact hail on house: Roof damaged (slightly)	910	0.020	893	0.023	0.827
	[50]	[0.011]	[50]	[0.008]	
Impact hail on house: Roof + Walls (Moderately)	910	0.002	893	0.002	0.978
	[50]	[0.002]	[50]	[0.002]	
Impact hail on house: Destroyed (Severe)	910	0.002	893	0.006	0.213
	[50]	[0.002]	[50]	[0.002]	
Impact frost on house: Not Damaged	910	1.000	893	0.999	0.321
	[50]	[0.000]	[50]	[0.001]	
Impact frost on house: Roof damaged (slightly)	910	0.000	893	0.001	0.321
	[50]	[0.000]	[50]	[0.001]	
Impact flood on house: Not Damaged	910	0.975	893	0.961	0.310
	[50]	[0.012]	[50]	[0.008]	
Impact flood on house: Roof damaged (slightly)	910	0.007	893	0.015	0.277
	[50]	[0.004]	[50]	[0.006]	
Impact flood on house: Roof + Walls (Moderately)	910	0.007	893	0.013	0.320
	[50]	[0.003]	[50]	[0.005]	
Impact flood on house: Destroyed (Severe)	910	0.010	893	0.004	0.414
	[50]	[0.007]	[50]	[0.002]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 22. Damages to the assets caused by climate-related hazards (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact strong wind on assets: Not Damaged	910	0.908	893	0.900	0.684
	[50]	[0.012]	[50]	[0.017]	
Impact strong wind on assets: Roof damaged (slightly)	910	0.021	893	0.035	0.157
	[50]	[0.005]	[50]	[0.008]	
Impact strong wind on assets: Roof + Walls (Moderately)	910	0.028	893	0.023	0.518
	[50]	[0.006]	[50]	[0.006]	
Impact strong wind on assets: Destroyed (Severe)	910	0.042	893	0.042	0.994
	[50]	[0.010]	[50]	[0.012]	
Impact drought on assets: Not Damaged	910	0.998	893	0.999	0.780
	[50]	[0.001]	[50]	[0.001]	
Impact drought on assets: Roof damaged (slightly)	910	0.002	893	0.000	0.206
	[50]	[0.001]	[50]	[0.000]	
Impact drought on assets: Roof + Walls (Moderately)	910	0.000	893	0.000	N/A
	[50]	[0.000]	[50]	[0.000]	
Impact drought on assets: Destroyed (Severe)	910	0.000	893	0.001	0.317
	[50]	[0.000]	[50]	[0.001]	
Impact hail on assets: Not Damaged	910	0.991	893	0.989	0.738
	[50]	[0.004]	[50]	[0.005]	
Impact hail on assets: Roof damaged (slightly)	910	0.004	893	0.003	0.834
	[50]	[0.002]	[50]	[0.002]	
Impact hail on assets: Roof + Walls (Moderately)	910	0.003	893	0.004	0.617
	[50]	[0.002]	[50]	[0.002]	
Impact hail on assets: Destroyed (Severe)	910	0.002	893	0.003	0.718
	[50]	[0.001]	[50]	[0.003]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 23. Damages to the assets caused by climate-related hazards (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact frost on assets: Not Damaged	910	0.999	893	0.999	0.593
	[50]	[0.001]	[50]	[0.001]	
Impact frost on assets: Roof damaged (slightly)	910	0.001	893	0.000	0.326
	[50]	[0.001]	[50]	[0.000]	
Impact frost on assets: Roof + Walls (Moderately)	910	0.000	893	0.001	0.316
	[50]	[0.000]	[50]	[0.001]	
Impact flood on assets: Not Damaged	910	0.978	893	0.981	0.751
	[50]	[0.007]	[50]	[0.006]	
Impact flood on assets: Roof damaged (slightly)	910	0.007	893	0.006	0.757
	[50]	[0.003]	[50]	[0.002]	
Impact flood on assets: Roof + Walls (Moderately)	910	0.005	893	0.006	0.790
	[50]	[0.002]	[50]	[0.003]	
Impact flood on assets: Destroyed (Severe)	910	0.010	893	0.008	0.726
	[50]	[0.004]	[50]	[0.004]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 24. Other damages caused by climate-related hazards (number of days lost)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone transport	910	2.312	893	3.377	0.200
	[50]	[0.377]	[50]	[0.739]	
Damage drought transport	909	0.012	893	0.008	0.790
	[50]	[0.010]	[50]	[0.008]	
Damage hail transport	910	0.009	893	0.020	0.369
	[50]	[0.005]	[50]	[0.011]	
Damage frost transport	910	0.030	893	0.009	0.279
	[50]	[0.019]	[50]	[0.007]	
Damage flood transport	910	1.557	893	2.296	0.287
	[50]	[0.260]	[50]	[0.643]	
Damage cyclone injuries	905	1.088	887	0.818	0.472
	[50]	[0.338]	[50]	[0.164]	
Damage drought injuries	909	0.761	892	0.398	0.264
	[50]	[0.307]	[50]	[0.107]	
Damage hail injuries	905	0.004	892	0.007	0.658
	[50]	[0.003]	[50]	[0.004]	
Damage frost injuries	906	0.059	889	0.245	0.299
	[50]	[0.031]	[50]	[0.176]	
Damage flood injuries	904	0.338	887	0.072	0.281
	[50]	[0.245]	[50]	[0.020]	
Damage cyclone loss of school time	910	2.547	893	2.657	0.796
	[50]	[0.365]	[50]	[0.224]	
Damage drought lack of school time	910	0.026	893	0.015	0.606
	[50]	[0.019]	[50]	[0.010]	
Damage hail lack of school time	910	0.026	893	0.012	0.331
	[50]	[0.013]	[50]	[0.006]	
Damage frost lack of school time	910	0.006	893	0.008	0.828
	[50]	[0.005]	[50]	[0.006]	
Damage flood lack of school time	909	1.163	893	1.464	0.286
	[50]	[0.208]	[50]	[0.191]	
Damage cyclone cultivation	910	0.549	893	0.577	0.856
	[50]	[0.110]	[50]	[0.110]	
Damage drought cultivation	910	0.017	893	0.020	0.847
	[50]	[0.008]	[50]	[0.014]	
Damage hail cultivation	910	0.017	893	0.045	0.394
	[50]	[0.008]	[50]	[0.032]	
Damage frost cultivation	910	0.000	893	0.032	0.203
	[50]	[0.000]	[50]	[0.025]	
Damage flood cultivation	910	0.376	893	0.470	0.478
	[50]	[0.084]	[50]	[0.103]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 25. Damages to crop harvest caused by climate-related hazards (% harvest decrease by type of crop)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone crop top 1	910	22.294	893	24.652	0.492
	[50]	[2.665]	[50]	[2.167]	
Damage drought crop top 1	910	12.914	893	11.276	0.530
	[50]	[2.000]	[50]	[1.677]	
Damage hail crop top 1	910	3.723	893	4.152	0.771
	[50]	[0.896]	[50]	[1.172]	
Damage frost crop top 1	910	0.532	893	0.880	0.308
	[50]	[0.184]	[50]	[0.287]	
Damage flood crop top 1	910	11.433	893	13.895	0.383
	[50]	[1.808]	[50]	[2.165]	
Damage cyclone crop top 2	910	14.743	893	19.358	0.088*
	[50]	[2.036]	[50]	[1.754]	
Damage drought crop top2	910	3.851	893	3.983	0.901
	[50]	[0.790]	[50]	[0.718]	
Damage hail crop top 2	910	3.191	893	3.084	0.926
	[50]	[0.879]	[50]	[0.750]	
Damage frost crop top 2	910	0.964	893	0.875	0.853
	[50]	[0.337]	[50]	[0.346]	
Damage flood crop top 2	910	3.832	893	7.356	0.093*
	[50]	[0.978]	[50]	[1.841]	
Damage cyclone crop top 3	910	11.798	893	13.514	0.484
	[50]	[2.040]	[50]	[1.365]	
Damage drought crop top 3	827	3.497	826	3.112	0.698
	[50]	[0.718]	[50]	[0.689]	
Damage hail crop top 3	910	1.961	893	1.693	0.670
	[50]	[0.499]	[50]	[0.382]	
Damage frost crop top 3	910	0.638	893	1.091	0.410
	[50]	[0.244]	[50]	[0.492]	
Damage flood crop top 3	910	2.970	893	5.053	0.081*
	[50]	[0.668]	[50]	[0.982]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 26. Damages to forest products caused by climate-related hazards (% decrease by forest product)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone forest top 1	908	7.268	893	6.442	0.719
	[50]	[1.963]	[50]	[1.201]	
Damage drought forest top 1	909	2.167	893	1.136	0.405
	[50]	[1.190]	[50]	[0.345]	
Damage hail forest top 1	909	1.106	893	0.735	0.527
	[50]	[0.474]	[50]	[0.347]	
Damage frost forest top 1	910	0.120	893	0.379	0.378
	[50]	[0.087]	[50]	[0.281]	
Damage flood forest top 1	909	2.159	893	2.354	0.859
	[50]	[0.888]	[50]	[0.652]	
Damage cyclone forest top 2	910	3.543	891	2.792	0.551
	[50]	[1.146]	[50]	[0.526]	
Damage drought forest top 2	910	0.308	893	0.567	0.378
	[50]	[0.171]	[50]	[0.238]	
Damage hail forest top 2	910	0.358	893	0.207	0.424
	[50]	[0.159]	[50]	[0.102]	
Damage frost forest top 2	910	0.000	893	0.120	0.316
	[50]	[0.000]	[50]	[0.119]	
Damage flood forest top 2	910	1.376	893	1.473	0.923
	[50]	[0.770]	[50]	[0.640]	
Damage cyclone forest top 3	909	1.193	893	1.709	0.361
	[50]	[0.322]	[50]	[0.464]	
Damage drought forest top 3	910	0.026	893	0.102	0.325
	[50]	[0.026]	[50]	[0.073]	
Damage hail forest top 3	910	0.228	893	0.042	0.347
	[50]	[0.197]	[50]	[0.026]	
Damage frost forest top 3	910	0.061	893	0.054	0.930
	[50]	[0.061]	[50]	[0.054]	
Damage flood forest top 3	910	0.182	893	0.210	0.832
	[50]	[0.107]	[50]	[0.076]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 27. Damages to animal products caused by climate-related hazards (% decrease by animals)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone animals top 1	910	1.401	893	1.512	0.818
	[50]	[0.280]	[50]	[0.394]	
Damage drought animals top 1	909	1.465	893	1.847	0.690
	[50]	[0.622]	[50]	[0.733]	
Damage hail animals top 1	910	0.119	893	0.240	0.420
	[50]	[0.072]	[50]	[0.131]	
Damage frost animals top 1	910	0.138	893	0.549	0.279
	[50]	[0.080]	[50]	[0.370]	
Damage flood animals top 1	910	0.210	893	0.908	0.117
	[50]	[0.099]	[50]	[0.432]	
Damage cyclone animals top 2	910	0.657	893	1.131	0.416
	[50]	[0.231]	[50]	[0.535]	
Damage drought animals top 2	910	1.811	893	0.854	0.150
	[50]	[0.559]	[50]	[0.355]	
Damage hail animals top 2	910	0.033	893	0.080	0.446
	[50]	[0.025]	[50]	[0.057]	
Damage frost animals top 2	910	0.057	893	0.129	0.409
	[50]	[0.038]	[50]	[0.079]	
Damage flood animals top 2	910	0.149	893	0.875	0.174
	[50]	[0.073]	[50]	[0.528]	
Damage cyclone animals top 3	910	0.653	893	0.189	0.103
	[50]	[0.271]	[50]	[0.083]	
Damage drought animals top 3	908	0.678	893	0.101	0.109
	[50]	[0.351]	[50]	[0.074]	
Damage hail animals top 3	910	0.000	893	0.001	0.328
	[50]	[0.000]	[50]	[0.001]	
Damage frost animals top 3	910	0.012	893	0.029	0.474
	[50]	[0.010]	[50]	[0.022]	
Damage flood animals top 3	909	0.278	893	0.269	0.976
	[50]	[0.215]	[50]	[0.237]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 28. Number of days in the past 12 months during which the household lacked food and water

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Lack of food days	909	12.739	892	15.347	0.444
	[50]	[1.669]	[50]	[2.977]	
Lack of water domestic days	908	10.140	893	8.519	0.550
	[50]	[2.253]	[50]	[1.512]	
Lack of water for agriculture	907	27.956	893	27.043	0.854
	[50]	[2.836]	[50]	[4.083]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 29. Strategies used to reduce sensitivity to climate-related hazards (for crops) (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response soil conservation used	910	0.398	894	0.461	0.497
	[50]	[0.072]	[50]	[0.059]	
Response agroforestry used	910	0.400	894	0.468	0.344
	[50]	[0.057]	[50]	[0.043]	
Response terracing used	910	0.210	894	0.245	0.641
	[50]	[0.064]	[50]	[0.039]	
Response resistant crops	910	0.206	894	0.317	0.052*
	[50]	[0.043]	[50]	[0.038]	
Response multi crops description	910	0.366	894	0.489	0.038**
	[50]	[0.048]	[50]	[0.034]	
Response irrigation description	910	0.677	893	0.683	0.908
	[50]	[0.042]	[50]	[0.033]	
Response off season rice	910	0.350	894	0.323	0.654
	[50]	[0.037]	[50]	[0.048]	
Response storage	910	0.312	894	0.290	0.571
	[50]	[0.031]	[50]	[0.022]	
Response pest management	910	0.383	894	0.303	0.036**
	[50]	[0.026]	[50]	[0.028]	
Response saving groups	910	0.064	894	0.126	0.106
	[50]	[0.020]	[50]	[0.032]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 30. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response soil conservation cyclone	245	0.720	257	0.692	0.735
	[40]	[0.058]	[42]	[0.058]	
Response soil conservation flood	193	0.802	211	0.710	0.305
	[38]	[0.060]	[38]	[0.068]	
Response soil conservation drought	206	0.758	235	0.715	0.561
	[39]	[0.045]	[46]	[0.058]	
Response soil conservation hail	123	0.372	142	0.265	0.491
	[28]	[0.136]	[31]	[0.074]	
Response soil conservation frost	128	0.526	156	0.346	0.202
	[24]	[0.119]	[27]	[0.075]	
Response agroforestry cyclone	304	0.598	334	0.593	0.928
	[44]	[0.041]	[43]	[0.034]	
Response agroforestry flood	222	0.590	272	0.542	0.552
	[38]	[0.047]	[40]	[0.065]	
Response agroforestry drought	263	0.671	287	0.716	0.438
	[43]	[0.045]	[45]	[0.037]	
Response agroforestry hail	150	0.296	172	0.173	0.418
	[31]	[0.133]	[31]	[0.073]	
Response agroforestry frost	133	0.400	188	0.168	0.059*
	[25]	[0.103]	[26]	[0.063]	
Response terracing cyclone	162	0.501	225	0.365	0.298
	[24]	[0.123]	[32]	[0.044]	
Response terracing flood	120	0.625	192	0.568	0.696
	[21]	[0.130]	[31]	[0.071]	
Response terracing drought	128	0.515	185	0.404	0.412
	[24]	[0.118]	[33]	[0.066]	
Response terracing hail	76	0.323	122	0.109	0.281
	[17]	[0.191]	[19]	[0.052]	
Response terracing frost	88	0.326	143	0.130	0.252
	[17]	[0.161]	[19]	[0.058]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 31. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response resistant crops cyclone	174	0.529	244	0.632	0.176
	[37]	[0.060]	[43]	[0.046]	
Response resistant crops flood	119	0.558	186	0.566	0.932
	[31]	[0.066]	[38]	[0.070]	
Response resistant crops drought	147	0.506	200	0.645	0.088*
	[39]	[0.068]	[44]	[0.044]	
Response resistant crops hail	66	0.307	100	0.316	0.958
	[24]	[0.144]	[22]	[0.075]	
Response resistant crops frost	72	0.423	128	0.364	0.568
	[21]	[0.081]	[23]	[0.064]	
Response multi crops cyclone	270	0.528	374	0.589	0.479
	[40]	[0.072]	[43]	[0.048]	
Response multi crops flood	200	0.481	255	0.528	0.692
	[35]	[0.096]	[36]	[0.070]	
Response multi crops drought	233	0.659	247	0.584	0.334
	[42]	[0.068]	[42]	[0.037]	
Response multi crops hail	134	0.208	161	0.257	0.500
	[26]	[0.049]	[27]	[0.055]	
Response multi crops frost	118	0.364	173	0.233	0.265
	[19]	[0.102]	[24]	[0.058]	
Response irrigation cyclone	460	0.696	425	0.735	0.590
	[46]	[0.063]	[43]	[0.039]	
Response irrigation flood	384	0.795	447	0.805	0.905
	[47]	[0.066]	[46]	[0.051]	
Response irrigation drought	425	0.830	395	0.782	0.359
	[49]	[0.038]	[48]	[0.037]	
Response irrigation hail	208	0.233	212	0.220	0.920
	[33]	[0.102]	[31]	[0.077]	
Response irrigation frost	159	0.385	213	0.232	0.262
	[24]	[0.112]	[26]	[0.076]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 32. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 3)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response off season rice cyclone	245	0.526	235	0.464	0.551
	[35]	[0.052]	[36]	[0.091]	
Response off season rice flood	153	0.527	164	0.461	0.593
	[31]	[0.099]	[30]	[0.076]	
Response off season rice drought	238	0.420	284	0.651	0.046**
	[38]	[0.084]	[39]	[0.078]	
Response off season rice hail	81	0.323	99	0.454	0.398
	[22]	[0.101]	[22]	[0.118]	
Response off season rice frost	68	0.371	114	0.413	0.751
	[16]	[0.043]	[18]	[0.124]	
Response storage cyclone	236	0.547	288	0.480	0.439
	[42]	[0.049]	[47]	[0.071]	
Response storage flood	165	0.529	223	0.448	0.296
	[37]	[0.040]	[41]	[0.067]	
Response storage drought	193	0.541	209	0.432	0.261
	[39]	[0.073]	[39]	[0.063]	
Response storage hail	105	0.229	131	0.196	0.711
	[27]	[0.072]	[30]	[0.049]	
Response storage frost	88	0.313	137	0.165	0.090*
	[16]	[0.066]	[22]	[0.056]	
Response pest management cyclone	271	0.338	248	0.327	0.851
	[40]	[0.043]	[37]	[0.042]	
Response pest management floods	190	0.412	194	0.333	0.295
	[40]	[0.049]	[37]	[0.057]	
Response pest management drought	300	0.675	289	0.564	0.335
	[43]	[0.086]	[46]	[0.076]	
Response pest management hail	117	0.372	118	0.090	0.005***
	[31]	[0.092]	[26]	[0.029]	
Response pest management frost	91	0.374	137	0.188	0.075*
	[21]	[0.070]	[23]	[0.076]	
Response saving groups cyclone	124	0.163	183	0.247	0.476
	[18]	[0.083]	[30]	[0.085]	
Response saving groups flood	86	0.138	135	0.328	0.161
	[14]	[0.075]	[27]	[0.112]	
Response saving groups drought	93	0.116	138	0.150	0.620
	[17]	[0.035]	[25]	[0.059]	
Response saving groups hail	47	0.048	83	0.142	0.134
	[14]	[0.036]	[17]	[0.051]	
Response saving groups frost	59	0.066	109	0.123	0.408
	[12]	[0.050]	[17]	[0.047]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 33. Top three strategies used to reduce sensitivity to climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Soil conservation: Top 1	255	0.502	284	0.422	0.388
	[41]	[0.054]	[47]	[0.076]	
Soil conservation: Top 2	255	0.270	284	0.300	0.521
	[41]	[0.030]	[47]	[0.035]	
Soil conservation: Top 3	255	0.228	284	0.279	0.439
	[41]	[0.035]	[47]	[0.056]	
Agroforestry and tree planting: Top 1	201	0.356	225	0.331	0.735
	[46]	[0.061]	[46]	[0.043]	
Agroforestry and tree planting: Top 2	201	0.335	225	0.346	0.818
	[46]	[0.040]	[46]	[0.028]	
Agroforestry and tree planting: Top 3	201	0.309	225	0.324	0.841
	[46]	[0.058]	[46]	[0.039]	
Contour plowing[27]/terracing: Top 1	90	0.416	129	0.306	0.201
	[23]	[0.073]	[32]	[0.044]	
Contour plowing/terracing: Top 2	90	0.359	129	0.418	0.284
	[23]	[0.039]	[32]	[0.039]	
Contour plowing/terracing: Top 3	90	0.225	129	0.276	0.485
	[23]	[0.055]	[32]	[0.048]	
Changed to more resistant crops: Top 1	94	0.354	135	0.372	0.754
	[37]	[0.046]	[42]	[0.038]	
Changed to more resistant crops: Top 2	94	0.398	135	0.325	0.374
	[37]	[0.068]	[42]	[0.045]	
Changed to more resistant crops: Top 3	94	0.249	135	0.303	0.495
	[37]	[0.046]	[42]	[0.064]	
Multi cropping system: Top 1	210	0.191	256	0.303	0.042**
	[45]	[0.031]	[41]	[0.045]	
Multi cropping system: Top 2	210	0.458	256	0.326	0.018**
	[45]	[0.045]	[41]	[0.031]	
Multi cropping system: Top 3	210	0.351	256	0.370	0.693
	[45]	[0.032]	[41]	[0.038]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

[27] Contour plowing is the act of farming on a hill or a contoured area. The plows follow the contours of the land horizontally helping to reduce runoff of water. This practice help to prevent soil erosion in hilly and contoured areas by capturing the water runoff using water breaks to keep water contained.

Appendix table 34. Top three strategies used to reduce sensitivity to climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Irrigation systems: Top 1	503	0.522	503	0.557	0.604
	[49]	[0.049]	[49]	[0.046]	
Irrigation systems: Top 2	503	0.336	503	0.329	0.900
	[49]	[0.040]	[49]	[0.044]	
Irrigation systems: Top 3	503	0.141	503	0.114	0.329
	[49]	[0.023]	[49]	[0.016]	
Off season rice cultivation: Top 1	211	0.523	260	0.405	0.135
	[36]	[0.046]	[39]	[0.063]	
Off season rice cultivation: Top 2	211	0.290	260	0.319	0.630
	[36]	[0.038]	[39]	[0.047]	
Off season rice cultivation: Top 3	211	0.187	260	0.276	0.245
	[36]	[0.059]	[39]	[0.047]	
Improvement/creation of grain storage: Top 1	142	0.164	107	0.113	0.378
	[44]	[0.047]	[40]	[0.035]	
Improvement/creation of grain storage: Top 2	142	0.220	107	0.381	0.032**
	[44]	[0.058]	[40]	[0.046]	
Improvement/creation of grain storage: Top 3	142	0.615	107	0.506	0.264
	[44]	[0.083]	[40]	[0.052]	
Integrated pest management: Top 1	255	0.309	169	0.296	0.833
	[45]	[0.055]	[43]	[0.035]	
Integrated pest management: Top 2	255	0.399	169	0.392	0.883
	[45]	[0.037]	[43]	[0.036]	
Integrated pest management: Top 3	255	0.292	169	0.313	0.775
	[45]	[0.064]	[43]	[0.038]	
Establishment of saving groups: Top 1	13	0.178	23	0.114	0.652
	[8]	[0.119]	[14]	[0.078]	
Establishment of saving groups: Top 2	13	0.519	23	0.297	0.419
	[8]	[0.197]	[14]	[0.190]	
Establishment of saving groups: Top 3	13	0.303	23	0.588	0.298
	[8]	[0.176]	[14]	[0.206]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 35. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Soil conservation: lack of money	560	0.160	524	0.198	0.373
	[49]	[0.028]	[50]	[0.032]	
Soil conservation: lack of knowledge/skills	560	0.430	524	0.447	0.822
	[49]	[0.065]	[50]	[0.041]	
Soil conservation: lack of interest/not useful	560	0.189	524	0.164	0.430
	[49]	[0.024]	[50]	[0.020]	
Soil conservation: others	560	0.222	524	0.191	0.513
	[49]	[0.041]	[50]	[0.025]	
Agroforestry & tree planting: lack of knowledge/skills	534	0.515	508	0.478	0.616
	[50]	[0.055]	[50]	[0.049]	
Agroforestry & tree planting: lack of interest/not useful	534	0.177	508	0.151	0.600
	[50]	[0.037]	[50]	[0.033]	
Agroforestry & tree planting: lack of time	534	0.174	508	0.139	0.300
	[50]	[0.025]	[50]	[0.022]	
Agroforestry & tree planting: others	534	0.134	508	0.232	0.034**
	[50]	[0.032]	[50]	[0.032]	
Contour plowing/terracing: lack of knowledge/skills	743	0.673	676	0.557	0.046**
	[50]	[0.047]	[50]	[0.034]	
Contour plowing/terracing: lack of interest/not useful	743	0.159	676	0.221	0.187
	[50]	[0.033]	[50]	[0.034]	
Contour plowing/terracing: others	743	0.168	676	0.222	0.197
	[50]	[0.026]	[50]	[0.032]	
Changed to more resistant crops: lack of money	722	0.226	636	0.278	0.235
	[50]	[0.024]	[50]	[0.037]	
Changed to more resistant crops: lack of knowledge/skills	722	0.476	636	0.425	0.303
	[50]	[0.027]	[50]	[0.041]	
Changed to more resistant crops: lack of technology/tools	722	0.042	636	0.029	0.479
	[50]	[0.016]	[50]	[0.010]	
Changed to more resistant crops: lack of interest/not useful	722	0.147	636	0.143	0.945
	[50]	[0.030]	[50]	[0.036]	
Changed to more resistant crops: others	722	0.109	636	0.124	0.662
	[50]	[0.019]	[50]	[0.029]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 36. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Multi cropping system: lack of knowledge/skills	568	0.468	474	0.366	0.120
	[50]	[0.037]	[50]	[0.054]	
Multi cropping system: lack of interest/not useful	568	0.333	474	0.353	0.745
	[50]	[0.032]	[50]	[0.053]	
Multi cropping system: others	568	0.199	474	0.281	0.185
	[50]	[0.040]	[50]	[0.047]	
Irrigation systems: lack of money	305	0.096	277	0.119	0.421
	[47]	[0.018]	[46]	[0.023]	
Irrigation systems: lack of knowledge/skills	305	0.212	277	0.247	0.612
	[47]	[0.052]	[46]	[0.045]	
Irrigation systems: lack of technology/tools	305	0.286	277	0.243	0.697
	[47]	[0.095]	[46]	[0.057]	
Irrigation systems: lack of interest/not useful	305	0.174	277	0.135	0.438
	[47]	[0.040]	[46]	[0.030]	
Irrigation systems: lack of time	305	0.070	277	0.112	0.203
	[47]	[0.017]	[46]	[0.029]	
Irrigation systems: others	305	0.163	277	0.143	0.713
	[47]	[0.043]	[46]	[0.030]	
Off season rice cultivation: lack of knowledge/skills	594	0.251	537	0.178	0.217
	[49]	[0.046]	[48]	[0.036]	
Off season rice cultivation: lack of interest/not useful	594	0.239	537	0.241	0.973
	[49]	[0.031]	[48]	[0.043]	
Off season rice cultivation: lack of time	594	0.077	537	0.090	0.671
	[49]	[0.016]	[48]	[0.026]	
Off season rice cultivation: others	594	0.434	537	0.492	0.533
	[49]	[0.061]	[48]	[0.071]	
Improvement/creation of grain storage: lack of money	642	0.496	618	0.417	0.160
	[49]	[0.041]	[50]	[0.037]	
Improvement/creation of grain storage: lack of knowledge/skills	642	0.110	618	0.109	0.982
	[49]	[0.025]	[50]	[0.024]	
Improvement/creation of grain storage: lack of interest/not useful	642	0.151	618	0.180	0.439
	[49]	[0.027]	[50]	[0.027]	
Improvement/creation of grain storage: others	642	0.244	618	0.294	0.329
	[49]	[0.023]	[50]	[0.046]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 37.Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 3)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Integrated pest management: lack of money	546	0.531	595	0.533	0.976
	[50]	[0.040]	[50]	[0.042]	
Integrated pest management: lack of knowledge/skills	546	0.287	595	0.310	0.732
	[50]	[0.046]	[50]	[0.047]	
Integrated pest management: lack of interest/not useful	546	0.071	595	0.060	0.542
	[50]	[0.014]	[50]	[0.012]	
Integrated pest management: others	546	0.110	595	0.097	0.693
	[50]	[0.020]	[50]	[0.024]	
Establishment of saving groups: lack of money	834	0.438	791	0.360	0.436
	[50]	[0.087]	[50]	[0.048]	
Establishment of saving groups: lack of knowledge/skills	834	0.130	791	0.131	0.994
	[50]	[0.032]	[50]	[0.034]	
Establishment of saving groups: lack of interest/not useful	834	0.259	791	0.294	0.562
	[50]	[0.046]	[50]	[0.038]	
Establishment of saving groups: others	834	0.173	791	0.215	0.359
	[50]	[0.035]	[50]	[0.030]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 38. Strategies used to reduce sensitivity to specific climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response animal production	908	0.459	885	0.419	0.544
	[50]	[0.043]	[50]	[0.051]	
Response animal production cyclone	274	0.704	302	0.639	0.331
	[45]	[0.052]	[45]	[0.042]	
Response animal production flood	197	0.687	206	0.580	0.214
	[41]	[0.063]	[34]	[0.058]	
Response animal production drought	249	0.761	248	0.617	0.084*
	[45]	[0.061]	[42]	[0.055]	
Response animal production hail	105	0.431	123	0.295	0.407
	[28]	[0.148]	[30]	[0.072]	
Response animal production frost	100	0.633	142	0.366	0.041**
	[24]	[0.110]	[31]	[0.066]	
Response fish farming	907	0.132	885	0.185	0.253
	[50]	[0.034]	[50]	[0.032]	
Response fish farming cyclone	139	0.336	191	0.340	0.943
	[27]	[0.045]	[36]	[0.042]	
Response fish farming flood	105	0.347	135	0.350	0.959
	[25]	[0.056]	[25]	[0.050]	
Response fish farming drought	117	0.379	154	0.372	0.950
	[25]	[0.068]	[29]	[0.077]	
Response fish farming hail	62	0.294	89	0.193	0.365
	[17]	[0.092]	[19]	[0.063]	
Response fish farming frost	65	0.246	109	0.127	0.085*
	[15]	[0.058]	[17]	[0.036]	
Response diversified livelihoods	855	0.353	848	0.348	0.904
	[49]	[0.024]	[50]	[0.038]	
Response diversified livelihoods cyclone	222	0.442	296	0.465	0.841
	[40]	[0.061]	[41]	[0.093]	
Response diversified livelihoods flood	158	0.345	189	0.435	0.409
	[39]	[0.069]	[35]	[0.083]	
Response diversified livelihoods drought	248	0.665	250	0.542	0.383
	[45]	[0.089]	[42]	[0.109]	
Response diversified livelihoods hail	90	0.232	131	0.304	0.389
	[27]	[0.031]	[29]	[0.078]	
Response diversified livelihoods frost	78	0.222	139	0.237	0.851
	[18]	[0.024]	[23]	[0.076]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 39. Top 3 strategies used to reduce sensitivity to climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Improved animal production: Top 1	326	0.853	319	0.835	0.770
	[48]	[0.035]	[49]	[0.051]	
Improved animal production: Top 2	326	0.142	319	0.143	0.981
	[48]	[0.035]	[49]	[0.042]	
Improved animal production: Top 3	326	0.004	319	0.021	0.165
	[48]	[0.003]	[49]	[0.012]	
Fish farming: Top 1	96	0.230	129	0.281	0.661
	[30]	[0.079]	[40]	[0.082]	
Fish farming: Top 2	96	0.555	129	0.574	0.842
	[30]	[0.063]	[40]	[0.072]	
Fish farming: Top 3	96	0.214	129	0.145	0.197
	[30]	[0.029]	[40]	[0.044]	
Diversified livelihoods: Top 1	270	0.639	294	0.629	0.894
	[49]	[0.050]	[47]	[0.055]	
Diversified livelihoods: Top 2	270	0.310	294	0.338	0.706
	[49]	[0.048]	[47]	[0.054]	
Diversified livelihoods: Top 3	270	0.051	294	0.034	0.525
	[49]	[0.023]	[47]	[0.014]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 40. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Improved animal production: lack of money	467	0.394	494	0.523	0.103
	[48]	[0.061]	[50]	[0.049]	
Improved animal production: lack of knowledge/skills	467	0.281	494	0.189	0.286
	[48]	[0.074]	[50]	[0.043]	
Improved animal production: lack of technology/tools	467	0.034	494	0.046	0.519
	[48]	[0.014]	[50]	[0.013]	
Improved animal production: lack of interest/not useful	467	0.088	494	0.077	0.723
	[48]	[0.024]	[50]	[0.017]	
Improved animal production: others	467	0.203	494	0.165	0.379
	[48]	[0.029]	[50]	[0.032]	
Fish farming: lack of money	727	0.080	687	0.103	0.391
	[49]	[0.018]	[50]	[0.020]	
Fish farming: lack of knowledge/skills	727	0.283	687	0.322	0.507
	[49]	[0.043]	[50]	[0.040]	
Fish farming: lack of land access	727	0.072	687	0.112	0.184
	[49]	[0.015]	[50]	[0.026]	
Fish farming: lack of technology/tools	727	0.320	687	0.200	0.204
	[49]	[0.084]	[50]	[0.041]	
Fish farming: lack of interest/not useful	727	0.128	687	0.124	0.893
	[49]	[0.019]	[50]	[0.022]	
Fish farming: others	727	0.117	687	0.138	0.514
	[49]	[0.023]	[50]	[0.023]	
Diversified livelihoods: lack of money	535	0.190	527	0.119	0.373
	[49]	[0.074]	[50]	[0.030]	
Diversified livelihoods: lack of knowledge/skills	535	0.279	527	0.264	0.797
	[49]	[0.044]	[50]	[0.036]	
Diversified livelihoods: lack of technology/tools	535	0.046	527	0.054	0.728
	[49]	[0.015]	[50]	[0.018]	
Diversified livelihoods: lack of interest/not useful	535	0.115	527	0.156	0.397
	[49]	[0.024]	[50]	[0.042]	
Diversified livelihoods: lack of time	535	0.290	527	0.349	0.222
	[49]	[0.033]	[50]	[0.035]	
Diversified livelihoods: others	535	0.080	527	0.058	0.343
	[49]	[0.020]	[50]	[0.013]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 41. Strategies used to reduce sensitivity to specific climate-related hazards, for forest and tree product (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reduce forest degradation	910	0.572	893	0.526	0.543
	[50]	[0.046]	[50]	[0.060]	
Reduce forest degradation: cyclone	390	0.702	390	0.698	0.952
	[48]	[0.062]	[47]	[0.039]	
Reduce forest degradation: flood	293	0.568	281	0.653	0.482
	[46]	[0.098]	[42]	[0.069]	
Reduce forest degradation: drought	409	0.912	354	0.801	0.024**
	[48]	[0.033]	[46]	[0.036]	
Reduce forest degradation: hail	171	0.402	155	0.325	0.604
	[41]	[0.105]	[33]	[0.105]	
Reduce forest degradation: frost	126	0.508	165	0.342	0.177
	[30]	[0.082]	[29]	[0.092]	
Diversify livelihoods	910	0.361	893	0.301	0.184
	[50]	[0.025]	[50]	[0.038]	
Diversify livelihoods: cyclone	251	0.401	284	0.438	0.727
	[39]	[0.058]	[38]	[0.090]	
Diversify livelihoods: flood	169	0.348	185	0.384	0.729
	[34]	[0.059]	[27]	[0.087]	
Diversify livelihoods: drought	278	0.609	248	0.502	0.421
	[41]	[0.087]	[37]	[0.099]	
Diversify livelihoods: hail	114	0.213	131	0.173	0.620
	[27]	[0.033]	[26]	[0.073]	
Diversify livelihoods: frost	94	0.258	149	0.180	0.288
	[18]	[0.042]	[25]	[0.059]	
Improve market products	910	0.104	894	0.135	0.332
	[50]	[0.023]	[50]	[0.022]	
Improve market products: cyclone	142	0.209	191	0.288	0.376
	[27]	[0.070]	[31]	[0.055]	
Improve market products: flood	102	0.188	138	0.273	0.408
	[20]	[0.085]	[26]	[0.059]	
Improve market products: drought	132	0.304	166	0.325	0.864
	[26]	[0.081]	[31]	[0.093]	
Improve market products: hail	72	0.185	89	0.148	0.700
	[20]	[0.084]	[20]	[0.049]	
Improve market products: frost	75	0.183	112	0.209	0.756
	[17]	[0.076]	[20]	[0.035]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 42. Top three strategies used to reduce sensitivity to climate-related hazards, for forest & tree product (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reducing forest degradation: Top 1	471 [49]	0.760 [0.035]	475 [49]	0.760 [0.037]	0.998
Reducing forest degradation: Top 2	471 [49]	0.231 [0.035]	475 [49]	0.210 [0.035]	0.665
Reducing forest degradation: Top 3	471 [49]	0.009 [0.004]	475 [49]	0.031 [0.012]	0.088*
Diversification of livelihoods: Top 1	288 [47]	0.598 [0.056]	289 [47]	0.601 [0.049]	0.969
Diversification of livelihoods: Top 2	288 [47]	0.370 [0.060]	289 [47]	0.331 [0.040]	0.590
Diversification of livelihoods: Top 3	288 [47]	0.032 [0.015]	289 [47]	0.067 [0.019]	0.147
Improving market products: Top 1	95 [28]	0.318 [0.075]	120 [37]	0.373 [0.059]	0.570
Improving market products: Top 2	95 [28]	0.462 [0.061]	120 [37]	0.453 [0.064]	0.927
Improving market products: Top 3	95 [28]	0.220 [0.050]	120 [37]	0.174 [0.051]	0.517

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 43. Main barriers for not using strategies to reduce sensitivity to climate-related hazards (for forest and tree product) (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reducing forest degradation: lack of money	336	0.083	310	0.076	0.837
	[44]	[0.026]	[47]	[0.019]	
Reducing forest degradation: lack of knowledge/skills	336	0.502	310	0.484	0.866
	[44]	[0.091]	[47]	[0.056]	
Reducing forest degradation: lack of interest/not useful	336	0.207	310	0.180	0.698
	[44]	[0.056]	[47]	[0.041]	
Reducing forest degradation: lack of time	336	0.042	310	0.080	0.210
	[44]	[0.020]	[47]	[0.024]	
Reducing forest degradation: others	336	0.168	310	0.180	0.816
	[44]	[0.044]	[47]	[0.033]	
Diversification of livelihoods: lack of money	512	0.162	504	0.137	0.651
	[49]	[0.048]	[47]	[0.030]	
Diversification of livelihoods: lack of knowledge/skills	512	0.385	504	0.351	0.558
	[49]	[0.039]	[47]	[0.041]	
Diversification of livelihoods: lack of technology/tools	512	0.111	504	0.047	0.060*
	[49]	[0.029]	[47]	[0.017]	
Diversification of livelihoods: lack of interest/not useful	512	0.114	504	0.127	0.637
	[49]	[0.018]	[47]	[0.020]	
Diversification of livelihoods: lack of time	512	0.175	504	0.287	0.018**
	[49]	[0.031]	[47]	[0.036]	
Diversification of livelihoods: others	512	0.054	504	0.050	0.843
	[49]	[0.016]	[47]	[0.013]	
Improving market products: lack of money	733	0.155	675	0.136	0.660
	[49]	[0.035]	[48]	[0.025]	
Improving market products: lack of knowledge/skills	733	0.441	675	0.517	0.228
	[49]	[0.035]	[48]	[0.052]	
Improving market products: lack of technology/tools	733	0.171	675	0.129	0.344
	[49]	[0.033]	[48]	[0.030]	
Improving market products: lack of interest/not useful	733	0.126	675	0.100	0.474
	[49]	[0.022]	[48]	[0.028]	
Improving market products: others	733	0.107	675	0.118	0.693
	[49]	[0.018]	[48]	[0.021]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 44. Number of days in the last 30 days the household members eat these food items

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cereals	910	29.850	894	29.564	0.096*
	[50]	[0.062]	[50]	[0.160]	
Legumes	910	8.899	894	10.064	0.514
	[50]	[1.366]	[50]	[1.152]	
Milk	910	0.718	894	1.021	0.381
	[50]	[0.207]	[50]	[0.277]	
Meat	910	3.140	879	3.662	0.487
	[50]	[0.537]	[50]	[0.526]	
Flesh	909	2.515	894	3.064	0.110
	[50]	[0.215]	[50]	[0.267]	
Organ	910	0.213	894	0.328	0.303
	[50]	[0.063]	[50]	[0.092]	
Fish	910	3.598	894	4.174	0.474
	[50]	[0.608]	[50]	[0.525]	
Eggs	910	1.421	894	1.530	0.682
	[50]	[0.202]	[50]	[0.175]	
Vegetables	906	8.982	875	10.884	0.438
	[50]	[1.718]	[49]	[1.754]	
Orange vegetables	910	2.699	894	2.973	0.672
	[50]	[0.456]	[50]	[0.462]	
Green leafy vegetables	910	18.864	894	19.888	0.328
	[50]	[0.673]	[50]	[0.801]	
Fruits	908	5.125	874	5.243	0.929
	[50]	[0.878]	[49]	[0.986]	
Orange fruits	910	5.658	894	4.775	0.591
	[50]	[1.179]	[50]	[1.147]	
Oil fat	909	18.190	894	19.947	0.275
	[50]	[1.299]	[50]	[0.951]	
Sugar	910	16.066	894	18.505	0.303
	[50]	[1.955]	[50]	[1.338]	
Condiments	910	29.127	894	29.614	0.120
	[50]	[0.288]	[50]	[0.121]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 45. Monetary value of food items for domestic consumption, with and without purchasing, in the last 30 days (in ariary) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cereals cash	910	35938.613	894	40731.633	0.394
	[50]	[4466.098]	[50]	[3412.480]	
Cereal credit	910	1397.376	894	3462.157	0.090*
	[50]	[455.755]	[50]	[1122.696]	
Cereals without purchasing	910	57546.333	894	51395.415	0.532
	[50]	[8549.891]	[50]	[4890.883]	
Tubers cash	910	4533.663	893	4626.277	0.952
	[50]	[924.899]	[50]	[1234.562]	
Tubers credit	910	217.148	893	247.880	0.857
	[50]	[110.660]	[50]	[129.656]	
Tubers without purchasing	910	29296.914	893	35242.200	0.179
	[50]	[2637.433]	[50]	[3539.638]	
Pulses cash	910	4400.338	894	5985.879	0.081*
	[50]	[627.058]	[50]	[650.557]	
Pulses credit	910	59.429	894	126.562	0.230
	[50]	[28.262]	[50]	[48.152]	
Pulses without purchasing	910	9063.647	894	7001.556	0.379
	[50]	[2101.122]	[50]	[1043.648]	
Fruits cash	910	980.876	894	1884.230	0.037**
	[50]	[206.409]	[50]	[376.969]	
Fruits credit	910	24.319	893	49.449	0.391
	[50]	[16.629]	[50]	[24.121]	
Fruits without purchasing	910	8870.099	893	10298.437	0.420
	[50]	[1332.119]	[50]	[1171.563]	
Fish/meat cash	910	11665.596	894	16439.402	0.207
	[50]	[2599.301]	[50]	[2736.638]	
Fish/meat credit	910	260.012	894	498.649	0.234
	[50]	[94.942]	[50]	[176.412]	
Fish/meat without purchasing	910	15349.770	894	19125.340	0.238
	[50]	[2136.337]	[50]	[2376.056]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 46 .Monetary value of food items for domestic consumption, with and without purchasing, in the last 30 days (in ariary) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Oil cash	910	4524.627	894	5341.575	0.198
	[50]	[358.015]	[50]	[523.368]	
Oil credit	910	58.467	894	53.533	0.886
	[50]	[18.029]	[50]	[29.290]	
Oil without purchasing	910	197.622	894	289.566	0.526
	[50]	[95.491]	[50]	[109.353]	
Milk cash	910	540.061	894	481.706	0.849
	[50]	[251.913]	[50]	[174.272]	
Milk credit	910	3.968	894	4.660	0.911
	[50]	[4.005]	[50]	[4.760]	
Milk without purchasing	910	478.133	894	506.287	0.924
	[50]	[211.496]	[50]	[204.691]	
Sugar cash	910	5675.293	894	6709.524	0.265
	[50]	[637.361]	[50]	[673.956]	
Sugar credit	910	60.453	894	93.975	0.589
	[50]	[31.724]	[50]	[53.438]	
Sugar without purchasing	910	282.339	894	673.954	0.078*
	[50]	[116.914]	[50]	[187.344]	
Tea cash	909	6634.324	894	6320.098	0.623
	[50]	[468.740]	[50]	[436.583]	
Tea credit	910	82.205	894	133.942	0.536
	[50]	[39.191]	[50]	[73.985]	
Tea without purchasing	910	1153.845	894	1100.868	0.919
	[50]	[455.376]	[50]	[256.681]	
Other cash	909	1148.811	892	1665.134	0.215
	[50]	[292.689]	[50]	[295.384]	
Other credit	910	45.900	892	51.636	0.878
	[50]	[31.261]	[50]	[20.821]	
Other without purchasing	908	215.534	892	499.094	0.288
	[50]	[113.493]	[50]	[241.483]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 47.Non-food household expenditure in the last 30 days (in ariary)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Expenditure Alcohol	909	5137.548	892	4428.330	0.280
	[50]	[569.897]	[50]	[324.526]	
Expenditure Soap	910	4959.137	894	5433.732	0.451
	[50]	[515.473]	[50]	[362.081]	
Expenditure Transport	910	2497.867	893	7814.707	0.066*
	[50]	[505.376]	[50]	[2831.281]	
Expenditure Fuel	909	3527.496	894	3002.331	0.345
	[50]	[393.608]	[50]	[392.743]	
Expenditure Water	910	56.176	894	66.543	0.869
	[50]	[51.833]	[50]	[35.715]	
Expenditure Electricity	910	878.786	894	879.506	0.998
	[50]	[281.634]	[50]	[143.041]	
Expenditure Communication	910	1579.725	894	2576.705	0.133
	[50]	[394.420]	[50]	[531.646]	
Expenditure Rent	909	798.922	893	948.783	0.727
	[50]	[290.608]	[50]	[317.475]	
Expenditure Medical Expenses	909	51135.219	892	52214.010	0.892
	[50]	[5524.538]	[50]	[5727.717]	
Expenditure Clothing	909	46064.550	893	43362.244	0.564
	[50]	[3816.604]	[50]	[2727.303]	
Expenditure Education	909	45183.814	892	44477.579	0.932
	[50]	[6258.502]	[50]	[5531.818]	
Expenditure Debts Repayment	908	39848.076	891	45221.609	0.599
	[50]	[8821.565]	[50]	[5162.641]	
Expenditure Social Events	909	53074.172	894	51217.376	0.862
	[50]	[8741.509]	[50]	[6238.927]	
Expenditure Agricultural Inputs	910	35142.443	894	35171.551	0.996
	[50]	[4325.842]	[50]	[4809.692]	
Expenditure Savings	906	11559.093	887	16108.354	0.410
	[50]	[2834.700]	[50]	[4740.607]	
Expenditure House Repairs	906	27750.642	891	48541.652	0.268
	[50]	[6933.962]	[50]	[17412.848]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 48. Livelihood-based coping strategies for food shortage in the last 30 days (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Spent savings or borrowed money: No, because no shortage of food	910	0.530	894	0.470	0.349
	[50]	[0.055]	[50]	[0.032]	
Spent savings or borrowed money: No, because assets already sold	910	0.100	894	0.105	0.890
	[50]	[0.024]	[50]	[0.025]	
Spent savings or borrowed money: Yes	910	0.370	894	0.425	0.318
	[50]	[0.042]	[50]	[0.035]	
Reduced meals quantities: No, because no shortage of food	910	0.294	894	0.274	0.751
	[50]	[0.053]	[50]	[0.036]	
Reduced meals quantities: No, because assets already sold	910	0.043	894	0.058	0.534
	[50]	[0.016]	[50]	[0.016]	
Reduced meals quantities: Yes	910	0.662	894	0.669	0.928
	[50]	[0.057]	[50]	[0.038]	
Harvested wild food: No, because no shortage of food	910	0.699	894	0.692	0.918
	[50]	[0.056]	[50]	[0.038]	
Harvested wild food: No, because assets already sold	910	0.164	894	0.153	0.834
	[50]	[0.042]	[50]	[0.034]	
Harvested wild food: Yes	910	0.136	894	0.155	0.642
	[50]	[0.029]	[50]	[0.027]	
Changed seed varieties: No, because no shortage of food	910	0.727	894	0.730	0.966
	[50]	[0.052]	[50]	[0.035]	
Changed seed varieties: No, because assets already sold	910	0.194	894	0.126	0.245
	[50]	[0.048]	[50]	[0.032]	
Changed seed varieties: Yes	910	0.079	894	0.144	0.034**
	[50]	[0.017]	[50]	[0.025]	
Withdrew children from school: No, because no shortage of food	908	0.732	894	0.767	0.571
	[50]	[0.051]	[50]	[0.037]	
Withdrew children from school: No, because assets already sold	908	0.207	894	0.151	0.340
	[50]	[0.048]	[50]	[0.035]	
Withdrew children from school: Yes	908	0.061	894	0.082	0.325
	[50]	[0.014]	[50]	[0.016]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 49. Livelihood-based coping strategies for food shortage in the last 30 days (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Harvested immature crops: No, because no shortage of food	910	0.553	894	0.532	0.660
	[50]	[0.037]	[50]	[0.029]	
Harvested immature crops: No, because assets already sold	910	0.157	894	0.129	0.527
	[50]	[0.036]	[50]	[0.027]	
Harvested immature crops: Yes	910	0.290	894	0.339	0.196
	[50]	[0.023]	[50]	[0.030]	
Sold productive assets: No, because no shortage of food	910	0.761	894	0.819	0.377
	[50]	[0.054]	[50]	[0.037]	
Sold productive assets: No, because assets already sold	910	0.217	894	0.152	0.305
	[50]	[0.052]	[50]	[0.037]	
Sold productive assets: Yes	910	0.021	894	0.029	0.513
	[50]	[0.007]	[50]	[0.009]	
Sold or abandoned land or building: No, because no shortage of food	910	0.756	894	0.835	0.234
	[50]	[0.054]	[50]	[0.039]	
Sold or abandoned land or building: No, because assets already sold	910	0.215	894	0.147	0.285
	[50]	[0.052]	[50]	[0.037]	
Sold or abandoned land or building: Yes	910	0.029	894	0.018	0.360
	[50]	[0.010]	[50]	[0.007]	
Sold last female animal or last seeds reserves: No, because no shortage of food	910	0.741	893	0.728	0.844
	[50]	[0.056]	[50]	[0.037]	
Sold last female animal or last seeds reserves: No, because assets already sold	910	0.186	893	0.142	0.440
	[50]	[0.046]	[50]	[0.033]	
Sold last female animal or last seeds reserves: Yes	910	0.074	893	0.130	0.079*
	[50]	[0.018]	[50]	[0.026]	
Migrated for longer/more people than usual: No, because no shortage of food	909	0.717	894	0.743	0.678
	[50]	[0.050]	[50]	[0.038]	
Migrated for longer/more people than usual: No, because assets already sold	909	0.201	894	0.144	0.339
	[50]	[0.048]	[50]	[0.035]	
Migrated for longer/more people than usual: Yes	909	0.082	894	0.113	0.250
	[50]	[0.017]	[50]	[0.021]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 50. Access to weather forecast (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Information received	910	0.565	894	0.616	0.525
	[50]	[0.073]	[50]	[0.036]	
Receive information from (source 1): Radio	596	0.632	577	0.673	0.502
	[49]	[0.040]	[50]	[0.047]	
Receive information from (source 1): Family or Friends	596	0.338	577	0.286	0.373
	[49]	[0.038]	[50]	[0.045]	
Receive information from (source 1): Others	596	0.029	577	0.041	0.415
	[49]	[0.010]	[50]	[0.010]	
Receive information from (source 2): Radio	134	0.078	153	0.065	0.737
	[38]	[0.032]	[40]	[0.021]	
Receive information from (source 2): Family or Friends	134	0.722	153	0.773	0.527
	[38]	[0.070]	[40]	[0.039]	
Receive information from (source 2): Others	134	0.200	153	0.162	0.650
	[38]	[0.076]	[40]	[0.037]	
Advice on how to use the information	853	0.257	828	0.272	0.784
	[50]	[0.045]	[50]	[0.036]	
Modify the practices after information	872	0.102	869	0.113	0.768
	[50]	[0.028]	[50]	[0.023]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 51. Understanding and knowledge of climate change (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Understanding of Climate Change: Do not understand	910	0.293	894	0.239	0.236
	[50]	[0.035]	[50]	[0.029]	
Understanding of Climate Change: More or less correct	910	0.579	894	0.615	0.345
	[50]	[0.029]	[50]	[0.024]	
Understanding of Climate Change: fully understand	910	0.127	894	0.146	0.562
	[50]	[0.021]	[50]	[0.025]	
Understanding of the impact of Climate Change: Do not understand	910	0.242	894	0.216	0.556
	[50]	[0.035]	[50]	[0.025]	
Understanding of the impact of Climate Change: More or less correct	910	0.544	894	0.577	0.400
	[50]	[0.027]	[50]	[0.028]	
Understanding of the impact of Climate Change: fully understand	910	0.214	894	0.207	0.867
	[50]	[0.034]	[50]	[0.031]	
Understanding that nature can help to adapt to CC: Do not understand	910	0.418	894	0.369	0.536
	[50]	[0.062]	[50]	[0.048]	
Understanding that nature can help to adapt to CC: More or less correct	910	0.396	894	0.464	0.194
	[50]	[0.036]	[50]	[0.039]	
Understanding that nature can help to adapt to CC: fully understand	910	0.187	894	0.167	0.705
	[50]	[0.038]	[50]	[0.035]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 52. Changes in forested areas in the last 5 years (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Quality: Greatly decreased	875	0.290	864	0.152	0.043**
	[50]	[0.062]	[50]	[0.026]	
Quality: Slightly decreased	875	0.200	864	0.225	0.386
	[50]	[0.014]	[50]	[0.025]	
Quality: About the same	875	0.289	864	0.291	0.973
	[50]	[0.042]	[50]	[0.031]	
Quality: Slightly increased	875	0.117	864	0.179	0.044**
	[50]	[0.022]	[50]	[0.021]	
Quality: Greatly increased	875	0.104	864	0.153	0.178
	[50]	[0.023]	[50]	[0.028]	
Quantity: Greatly decreased	876	0.273	876	0.172	0.174
	[50]	[0.068]	[50]	[0.029]	
Quantity: Slightly decreased	876	0.222	876	0.264	0.255
	[50]	[0.026]	[50]	[0.026]	
Quantity: About the same	876	0.244	876	0.254	0.842
	[50]	[0.037]	[50]	[0.032]	
Quantity: Slightly increased	876	0.121	876	0.155	0.297
	[50]	[0.024]	[50]	[0.022]	
Quantity: Greatly increased	876	0.140	876	0.155	0.706
	[50]	[0.029]	[50]	[0.029]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 53. Causes of deforestation and level of protection

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Main cause deforestation: Shifting cultivation	774	0.561	762	0.595	0.554
	[50]	[0.037]	[50]	[0.043]	
Main cause deforestation: Cropping	774	0.132	762	0.092	0.292
	[50]	[0.029]	[50]	[0.026]	
Main cause deforestation: Timber extraction	774	0.060	762	0.060	0.981
	[50]	[0.012]	[50]	[0.014]	
Main cause deforestation: Firewood	774	0.060	762	0.083	0.296
	[50]	[0.015]	[50]	[0.016]	
Main cause deforestation: Natural hazards	774	0.118	762	0.099	0.533
	[50]	[0.024]	[50]	[0.017]	
Main cause deforestation: Others	774	0.069	762	0.071	0.920
	[50]	[0.016]	[50]	[0.017]	
Satisfaction level of protection: Not at all satisfied	890	0.090	886	0.136	0.070*
	[50]	[0.014]	[50]	[0.021]	
Satisfaction level of protection: Slightly satisfied	890	0.114	886	0.114	0.992
	[50]	[0.020]	[50]	[0.014]	
Satisfaction level of protection: Moderately satisfied	890	0.241	886	0.224	0.623
	[50]	[0.023]	[50]	[0.027]	
Satisfaction level of protection: Very satisfied	890	0.448	886	0.390	0.195
	[50]	[0.034]	[50]	[0.029]	
Satisfaction level of protection: Extremely satisfied	890	0.107	886	0.137	0.287
	[50]	[0.017]	[50]	[0.022]	
Illegal activities: It is never OK	905	0.797	888	0.834	0.251
	[50]	[0.021]	[50]	[0.024]	
Illegal activities: It is sometime/under certain circumstance OK	905	0.184	888	0.150	0.325
	[50]	[0.025]	[50]	[0.024]	
Illegal activities: It is always OK	905	0.019	888	0.016	0.785
	[50]	[0.011]	[50]	[0.006]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 54. Opinions towards the management of protected areas by the VOI (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Violation of the rules: No	906	0.795	890	0.743	0.307
	[50]	[0.037]	[50]	[0.035]	
Violation of the rules: Yes, sometimes	906	0.084	890	0.114	0.254
	[50]	[0.020]	[50]	[0.018]	
Violation of the rules: Yes, always	906	0.121	890	0.143	0.512
	[50]	[0.024]	[50]	[0.023]	
Protected areas: Relying a lot less	902	0.533	885	0.615	0.120
	[50]	[0.043]	[50]	[0.031]	
Protected areas: Relying a slightly less	902	0.152	885	0.101	0.202
	[50]	[0.030]	[50]	[0.026]	
Protected areas: About the same	902	0.089	885	0.056	0.237
	[50]	[0.025]	[50]	[0.013]	
Protected areas: Relying a slightly more	902	0.064	885	0.066	0.936
	[50]	[0.013]	[50]	[0.010]	
Protected areas: Relying a lot more	902	0.161	885	0.162	0.996
	[50]	[0.038]	[50]	[0.026]	
Areas that should be protected and restored	907	0.235	890	0.255	0.702
	[50]	[0.039]	[50]	[0.035]	
VOI perception	885	4.295	878	4.262	0.704
	[50]	[0.051]	[50]	[0.070]	
Voice heard VOI man: No	777	0.070	762	0.077	0.786
	[50]	[0.016]	[50]	[0.018]	
Voice heard VOI man: Sometimes	777	0.132	762	0.155	0.365
	[50]	[0.017]	[50]	[0.020]	
Voice heard VOI man: yes	777	0.798	762	0.768	0.395
	[50]	[0.021]	[50]	[0.029]	
Voice heard VOI woman: No	392	0.132	478	0.103	0.509
	[47]	[0.034]	[49]	[0.026]	
Voice heard VOI woman: Sometimes	392	0.268	478	0.175	0.231
	[47]	[0.073]	[49]	[0.028]	
Voice heard VOI woman: yes	392	0.600	478	0.722	0.137
	[47]	[0.070]	[49]	[0.041]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 55. Markets (where products are sold and the main barriers to sell them)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Sell products: Market outside the village (%)	878	0.145	878	0.188	0.381
	[50]	[0.028]	[50]	[0.040]	
Sell products: Sold little things in the village (%)	878	0.077	878	0.100	0.446
	[50]	[0.023]	[50]	[0.020]	
Sell products: Commune's market (%)	878	0.618	878	0.471	0.106
	[50]	[0.056]	[50]	[0.071]	
Sell products: Collector (%)	878	0.045	878	0.089	0.183
	[50]	[0.013]	[50]	[0.030]	
Sell products: Do not sell (%)	878	0.050	878	0.097	0.394
	[50]	[0.021]	[50]	[0.052]	
Sell products: Others (%)	878	0.066	878	0.055	0.742
	[50]	[0.024]	[50]	[0.022]	
Market distance (in min)	845	141.295	829	112.633	0.161
	[50]	[17.555]	[50]	[10.371]	
Barrier: Low prices (%)	844	0.158	836	0.129	0.348
	[50]	[0.022]	[50]	[0.021]	
Barrier: Road inexistent (%)	844	0.491	836	0.476	0.804
	[50]	[0.048]	[50]	[0.041]	
Barrier: No barriers (%)	844	0.218	836	0.230	0.818
	[50]	[0.042]	[50]	[0.029]	
Barrier: Bad/Few or No production (%)	844	0.037	836	0.052	0.356
	[50]	[0.010]	[50]	[0.013]	
Barrier: Other (%)	844	0.096	836	0.113	0.614
	[50]	[0.026]	[50]	[0.022]	
Product value added (%)	910	0.084	894	0.104	0.510
	[50]	[0.018]	[50]	[0.024]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 56. Information about markets and organization membership (in %)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Information about market and prices	910	0.259	893	0.253	0.908
	[50]	[0.044]	[50]	[0.034]	
Source of information: Radio	271	0.323	241	0.319	0.960
	[42]	[0.046]	[41]	[0.065]	
Source of information: Family or Friends	271	0.651	241	0.591	0.507
	[42]	[0.048]	[41]	[0.078]	
Source of information: Others	271	0.026	241	0.090	0.091*
	[42]	[0.011]	[41]	[0.036]	
Advice was used	451	0.235	324	0.329	0.169
	[46]	[0.039]	[45]	[0.056]	
Practices were modified	243	0.267	187	0.301	0.643
	[41]	[0.048]	[37]	[0.055]	
Type of organization: Farmer's association	910	0.097	894	0.101	0.937
	[50]	[0.026]	[50]	[0.034]	
Type of organization: Women's group	910	0.228	894	0.314	0.153
	[50]	[0.033]	[50]	[0.050]	
Type of organization: Youth group	910	0.085	894	0.142	0.125
	[50]	[0.019]	[50]	[0.032]	
Type of organization: Others	910	0.087	894	0.115	0.461
	[50]	[0.026]	[50]	[0.028]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 57. Assets ownership (in %) (part 1)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Mobile phone	910	0.233	894	0.304	0.143
	[50]	[0.039]	[50]	[0.028]	
Radio	910	0.500	894	0.516	0.743
	[50]	[0.033]	[50]	[0.034]	
Television	910	0.048	894	0.038	0.529
	[50]	[0.012]	[50]	[0.009]	
Internet access	910	0.012	894	0.008	0.527
	[50]	[0.004]	[50]	[0.003]	
Mobile banking	910	0.050	894	0.056	0.644
	[50]	[0.010]	[50]	[0.009]	
VHS reader	910	0.075	894	0.108	0.281
	[50]	[0.020]	[50]	[0.022]	
Amplifier	910	0.070	894	0.099	0.232
	[50]	[0.015]	[50]	[0.019]	
Bed	910	0.702	894	0.751	0.448
	[50]	[0.057]	[50]	[0.030]	
Sewing Machine	910	0.084	894	0.078	0.774
	[50]	[0.018]	[50]	[0.013]	
Generator (group)	910	0.025	894	0.019	0.555
	[50]	[0.008]	[50]	[0.005]	
Petrol Lamp	910	0.567	894	0.578	0.880
	[50]	[0.060]	[50]	[0.048]	
Solar panel	910	0.258	894	0.294	0.510
	[50]	[0.038]	[50]	[0.038]	
Improved cooking stoves	910	0.045	894	0.041	0.765
	[50]	[0.013]	[50]	[0.009]	
Cleaver (big knife)	910	0.933	894	0.942	0.735
	[50]	[0.021]	[50]	[0.013]	
Machete	910	0.927	894	0.923	0.804
	[50]	[0.014]	[50]	[0.012]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 58. Assets ownership (in %) (part 2)

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Plough	910	0.176	894	0.138	0.499
	[50]	[0.036]	[50]	[0.043]	
Chainsaw	910	0.022	894	0.015	0.447
	[50]	[0.006]	[50]	[0.006]	
Storage room/facilities	910	0.290	894	0.239	0.252
	[50]	[0.032]	[50]	[0.030]	
Motor pump	910	0.013	894	0.002	0.066*
	[50]	[0.006]	[50]	[0.001]	
Sprayer	910	0.053	894	0.044	0.646
	[50]	[0.016]	[50]	[0.014]	
Rice husker	910	0.007	894	0.004	0.397
	[50]	[0.003]	[50]	[0.002]	
Kibota	910	0.008	894	0.005	0.528
	[50]	[0.004]	[50]	[0.002]	
Herse	910	0.084	894	0.060	0.327
	[50]	[0.020]	[50]	[0.014]	
Watering canister	910	0.163	894	0.172	0.831
	[50]	[0.030]	[50]	[0.026]	
Tractor or rototiller	910	0.012	894	0.008	0.472
	[50]	[0.005]	[50]	[0.003]	
Bicycle	910	0.066	894	0.054	0.592
	[50]	[0.019]	[50]	[0.014]	
Motorcycle/Moped	910	0.012	894	0.007	0.372
	[50]	[0.004]	[50]	[0.003]	
Oxcart	910	0.014	894	0.008	0.453
	[50]	[0.007]	[50]	[0.004]	
Lorry/ 4*4	910	0.001	894	0.005	0.238
	[50]	[0.001]	[50]	[0.004]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 59. Land preparation, harvest and processing

Variable	N/[Clusters]	(1) Phase 3 Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Land preparation people/day (rice)	899	15.752	875	16.772	0.785
	[50]	[2.899]	[50]	[2.375]	
Land preparation days (rice)	899	27.709	875	21.490	0.161
	[50]	[3.377]	[50]	[2.866]	
Land preparation people/day (other crops)	895	6.321	877	6.947	0.516
	[50]	[0.646]	[50]	[0.716]	
Land preparation days (other crops)	895	17.520	877	14.320	0.298
	[50]	[2.155]	[50]	[2.193]	
Land harvesting and processing people/days (rice)	898	17.428	875	14.792	0.623
	[50]	[4.516]	[50]	[2.913]	
Land harvesting and processing days (rice)	899	8.452	875	6.853	0.303
	[50]	[1.124]	[50]	[1.072]	
land harvesting and processing people/days (other crops)	884	3.296	871	3.677	0.447
	[50]	[0.352]	[50]	[0.357]	
Land harvesting and processing days (other crops)	883	55.233	869	54.950	0.985
	[50]	[11.099]	[50]	[10.780]	

The value displayed for t-tests are p-values. Standard errors are clustered at VOI level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

2. Balance tests between phase 1 VOI and the outside comparison group

When comparing socio-demographic characteristics between households of phase 1 VOI and households in Control Fokontany (comparison group), we observe, on average, a greater distance from Fokontany center for VOI phase 1 (45 minutes on average) than for the outside group (24 minutes on average). In contrast, the household distance of the control group to the closest forest is lower compared with the VOI phase 1. These differences are large and strongly significant (Appendix table 60). Ethnicity group is also different for "Betsileo" group, and "others" group, but the difference in percentage is small and weakly significant. However, the degree of variation is substantial for other groups and statistically strong (Appendix table 60).

Control group and phase 1 VOI also differ regarding head of households, especially for the category "male headed with wife/ wives", where the difference is large with a value of 70.7% for the control group and 83.7 % for VOI phase 1. For categories "female headed, divorced single or widowed", and "female headed husband away, wife that make most agricultural decision", a greater percentage is reported for the control group (14% and 11% respectively) compared with VOI Phase 1 (9% and 3.4% respectively) (Appendix table 61). These differences are all strongly significant. There are strongly significant differences regarding the percentages of elderly and of adults in the household. Regarding the education level of the head of the household, we observe a difference for the category "Lower/ junior high school", with a value of 8% for the control and 17 % for VOI phase 1 (Appendix table 61). A large and strongly significant difference is also observed for respondents that can speak Malagasy and French, with a greater percentage for households in phase 1 VOI (16.5%) compared to the outside group (8.5%).

There is a large difference between the control and phase 1 VOI regarding the reason of why people moved from a village to another province. Responses for moving "due to lack of land" differ importantly between control and phase 1 VOI, and to a lesser extent for "moving due to family". The difference is strongly significant for reasons "lack of land" and "move from village in other province" (Appendix table 62).

When comparing dwelling characteristics between households of phase 1 VOI and households in Control Fokontany (comparison group), we observe a large and strongly significant difference regarding the reason for not having toilets in the household "others" (Appendix table 63).

When comparing the main sources of livelihood/income during the wet season, secondary source of livelihoods classified in "other categories" has a higher value on average in the control group compared with households of phase 1 VOI. However, the difference is small and weakly significant (Appendix table 4). In the dry season, we observe also a small difference for tertiary source of livelihoods classified in "other categories", its value being greater for households of phase 1 VOI (12.3%) compared with households of the control group (22.2%), the statistical significance being weak (Appendix table 64).

Regarding the three most important crops grown by households, the value of "Crop 1 others", "Crop 2 sweet potatoes" and "Crop 2 Cassava" vary between the control group and households of phase 1 VOI (Appendix table 65). Sweet potatoes and cassava average values are higher in the control group compared with households of phase 1 VOI. Though these differences are small, they are strongly significant. Regarding “Taro crop 3”, the difference is small and weakly significant.

Regarding production and use of the most important crops, the average rice production is different (crop 1) for phase 1 VOI and the control group as well as consumption and selling. These differences are large and strongly significant (Appendix table 69).

When we compare the total production and use of the three most important livestock and domestic animals, we find a large difference for top 1 animal production and top 1 animal consumption. The average number of top 1 animal for households of phase 1 VOI is greater than in the control group. The statistical significance is strong for these two variables (Appendix table 70). This is also the case of top 2 animal, but we observe a small and weakly significant difference for production and consumption. The statistical significance is strong for top 1 animal storage.

When we compare changes in total production and in the use of the most important forest product, we find a large and strongly significant difference between the control group and households of phase 1 VOI (Appendix table 71).

When comparing changes that have negatively impacted households’ livelihoods in the last 12 months, there is a greater percentage of households that respond that access to inputs affected negatively their livelihood in phase 1 VOI compared with the control group. This difference is large and strongly significant. This is also the case of unpredictable rainfalls. Wind/cyclone intensity seems to have a greater impact in the control group than for households of phase 1 VOI, though the difference is small and weakly significant (Appendix table 72).

Related to the three main changes that most severely affected households’ livelihoods in the last 12 months, large differences are noticed for ”difficult access to agricultural inputs: Top 3” and “low market accessibility: Top 1”. A greater percentage of households in phase 1 VOI reported that difficult access to agricultural inputs are top 3 changes that affected their livelihood, and, on contrary, low market accessibility is mentioned as top 1 is more frequently mentioned in the control group compared with households of phase 1 VOI. These differences are strongly significant (Appendix table 73). We find an important difference in the percentage of households that responded that rainfall was more unpredictable (ranked as top 3 and top 2). The statistical significance is weak for the variable “more unpredictable rainfall: top 2”and strong for the variable “more unpredictable rainfall top 3”. (Appendix table 74). We find that the percentages of households that ranked “higher temperature” as top 3 and “more frequent hail” as top 3 are greater in phase 1 VOI compared with the control group, though weakly significant (Appendix table 75).

When we compare the impact of climate-related hazards on households, the differences are small, however strongly significant for cyclone latest year, drought latest year, hail latest year (Appendix table 76). When we compare by degree of severity of the shock, we observe that there is a difference for reporting hail reported as severe: the value is greater for households of phase 1 VOI, though the difference is small and weakly significant (Appendix table 78).

Regarding other damages caused by climate hazards, when we compare the responses of the control group to those of households of phase 1 VOI, we observe a small difference between the average number of school days lost, being higher in the control group (3 days) compared with phase 1 VOI (2 days)

(Appendix table 23). This difference is strongly significant. Damages due to floods on cultivation is more frequently reported in phase 1 VOI compared with the control group, the difference being large and strongly significant (Appendix table 81). Cyclone damages on top 1 crops, and drought damages on top 1 crops differ slightly. The value for these two variables is higher in the control group compared with households of phase 1 VOI (Appendix table 84). Damages to crops due to drought also differ importantly for top 2 and top 3 crops, greater values being reported by the control group. These differences are strongly significant (Appendix table 84). Regarding damages to forest products caused by climate-related hazards, we also observe a large and strongly significant difference (Appendix table 85).

Regarding the strategies used to reduce sensitivity to climate-related hazards for crops, there is an important difference in the percentage of households that responded that storage was used, being larger for households of phase 1 VOI. This difference is strongly significant (Appendix table 87). A large difference also arises for the response "agroforestry when facing frost", though weakly significant (Appendix table 88), similarly for the response "soil conservation" ranked top 1, top 2 and top 3 (Appendix table 91) and for "contour plowing/ terracing" ranked as top 1. For multi-cropping system ranked top 2, we observe a small but strongly significant difference (Appendix table 91). For the variable irrigation system ranked as top 3 and integrated pest management ranked as top 3, we find a small and weakly significant difference (Appendix table 92). However, for the variable integrated pest management ranked as top 2, we find a small but strongly significant difference (Appendix table 92).

Regarding the main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops, we find a large difference for "agroforestry & tree planting barrier: lack of interest/ not useful", with a higher percentage in phase 1 VOI (Appendix table 34). For barriers "lack of knowledge and skills" and "other categories" for coutour plowing/ terracing strategy, there is a small and weakly significant difference between the two groups (Appendix table 93). Several other barriers also differ importantly: lack of money, lack of interest/ not useful (barrier for not doing irrigation systems) and lack of knowledge and skills (off-season rice cultivation strategy). For the strategy such as off-season rice cultivation, we have responses related to barriers such as lack of interest/not useful; lack of knowledge or skills, lack of time differing between the two groups: the difference is small for lack of interest but more substantial for the other responses (Appendix table 94). It seems that lack of money is a barrier that is more important in phase 1 VOI compared with the control group for doing improvement/creation of grain storage. The difference is large and strongly significant (Appendix table 94). The barriers lack of money and others for the strategy of establishing saving groups differ importantly between households of phase 1 VOI to the control group, this difference being strongly significant (Appendix table 96).

For livestock, the frequency of the response "fish farming" as a strategy to reduce sensitivity to climate-related hazards differs importantly between the two groups, this difference being strongly significant (Appendix table 97). This is also the case of livelihood diversification, though this difference is weakly significant (Appendix table 97). Regarding the main barriers for not using these and other strategies, we find large differences for "lack of interest / not useful" for the fish farming strategy and "lack of money" for livelihood diversification, both differences being strongly significant (Appendix table 98). For the barrier "others" for livelihood diversification, the difference is also important but weakly significant (Appendix table 99).

Regarding strategies used to reduce sensitivity to specific climate-related hazards for forest and tree product, we find important differences for strategies "reducing forest degradation" and "improving market products" when facing frost (Appendix table 99). There is also a small and weakly significant difference for livelihood diversification (Appendix table 100). Among top three strategies, we find important differences for diversification of livelihoods top 1, diversification of livelihoods top 2, improving market products top 3, all strongly significant (Appendix table 100). There is also a notable difference for improving markets products top 1, though weakly significant (Appendix table 100). Regarding the main barriers for not using such strategies, we find large differences for those variables: "diversification of livelihoods: lack of money", "improving markets products: lack of money", both strongly significant (Appendix table 102).

The number of days household members eat food items differs between the two groups (5 days for control group and 3 days for phase 1 VOI), this difference being strongly significant (Appendix table 103). When comparing the monetary value of food items for domestic consumption, with and without purchases in the last 30 days, we find a large difference for the category "pulses not purchased", though weakly significant. We also find that fish and meat acquired through credit and fish/ meat not purchased, differ greatly between the two groups, the difference being strongly significant (Appendix table 104). Other differences are notable for sugar without purchasing, and teas cash (Appendix table 104). Regarding non-food expenditure, we find important differences for expenditure on social events and agricultural inputs, the difference being strongly significant only for the latter (Appendix table 106).

Regarding livelihood-based coping strategies for food shortage, there are large and strongly significant differences for the variables "reduced meal in quantities: no because assets already sold" or "reduced meals quantities : yes" (Appendix table 107).

Differences in a full and a lack of understanding of the impact of climate change are large and strongly significant. Households in phase 1 VOI seem to better understand climate change impacts compared with the control group (Appendix table 110).

Regarding changes in forested areas in the last five years, differences are important and strongly significant for the variables: Quality : greatly decreased, slightly decreased, about the same, slightly increased, greatly increased; Quantity: greatly decreased, slightly decreased, about the same, slightly increased (Appendix table 111). Regarding the causes of deforestation and level of protection, important differences are noticeable for main causes of deforestation: cropping, natural hazards, others, there is a substantial variation between average values of control groups and phase 1 VOI (Appendix table 111). This is also the case for the following variables: satisfaction level of protection : not at all satisfied, moderately satisfied, very satisfied, very satisfied, extremely satisfied, illegal activities :it is never OK, illegal activities : it is sometimes/ under certain circumstances ok, it is always OK. These differences are strongly significant, except for satisfaction level of protection: moderately satisfied (Appendix table 112).

When we compare the opinions toward the management of protected areas by the VOI, there are strongly significant differences regarding the variables: violation of the rules: No, yes sometimes, yes always and VOI perception (Appendix table 113).

When we compared the market aspect, we find that for "barrier : bad/ few or no production" there is an important and strongly significant difference between the two groups (Appendix table 114).

Regarding assets ownership, a small difference arises for machete, however the statistical significance is strong (Appendix table 56). There are also small differences between for the following variables : storage room/ facilities, sprayer, rice husker,kibota, herse, watering canister, tractor. However, these are strongly significant for sprayer, kibota, watering canister, and tractor (Appendix table 117).

When we compare land preparation, harvest and processing variables, differences are important and strongly significant for land preparation people, day (other crops), and land processing and harvesting days for others crops (Appendix table 118).

Appendix table 60. Socio-demographic characteristics of household members (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Household distances from Fokontany center (min)	926	24.359	892	45.434	0.013**
	[39]	[2.339]	[52]	[8.059]	
Household distance from closest forest (min)	925	80.075	892	61.606	0.047**
	[39]	[6.688]	[52]	[6.354]	
Ethnic group: Betsileo (%)	926	0.579	892	0.344	0.068*
	[39]	[0.091]	[52]	[0.090]	
Ethnic group: Betsimisaraka (%)	926	0.174	892	0.136	0.593
	[39]	[0.055]	[52]	[0.046]	
Ethnic group: Tanala (%)	926	0.159	892	0.225	0.467
	[39]	[0.055]	[52]	[0.072]	
Ethnic group: Others (%)	926	0.088	892	0.295	0.048**
	[39]	[0.067]	[52]	[0.079]	
Year of birth	926	1973.882	894	1974.888	0.378
	[39]	[0.749]	[52]	[0.861]	
Male headed, with a wife/wives (%)	926	0.707	894	0.837	0.003***
	[39]	[0.038]	[52]	[0.021]	
Male headed, divorced, single or widowed (%)	926	0.038	894	0.040	0.841
	[39]	[0.008]	[52]	[0.008]	
Female headed, divorced, single or widowed (%)	926	0.142	894	0.089	0.017**
	[39]	[0.015]	[52]	[0.016]	
Female headed, husband away, wife makes most HH/agricultural decision (%)	926	0.113	894	0.034	0.027**
	[39]	[0.033]	[52]	[0.011]	
Total members HH	925	6.177	894	6.276	0.679
	[39]	[0.185]	[52]	[0.155]	
Eldest in HH	925	0.369	894	0.299	0.088*
	[39]	[0.034]	[52]	[0.023]	
Adults in HH	925	2.398	894	2.565	0.072*
	[39]	[0.060]	[52]	[0.070]	
Youth in HH	925	1.152	894	1.179	0.787
	[39]	[0.068]	[52]	[0.071]	
Children in HH	925	1.248	894	1.246	0.977
	[39]	[0.071]	[52]	[0.053]	
Children <5 in HH	925	1.009	894	0.988	0.826
	[39]	[0.055]	[52]	[0.081]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 61. Socio-demographic characteristics of household members (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Children attending school	925	1.076	894	1.032	0.605
	[39]	[0.074]	[52]	[0.041]	
HH respondent: Has never gone to school (%)	926	0.224	894	0.165	0.189
	[39]	[0.037]	[52]	[0.025]	
HH respondent: Elementary school (%)	926	0.642	894	0.649	0.885
	[39]	[0.040]	[52]	[0.022]	
HH respondent: Lower/Junior High School (%)	926	0.116	894	0.158	0.123
	[39]	[0.020]	[52]	[0.018]	
HH respondent: Higher/Senior High School (%)	926	0.017	894	0.024	0.436
	[39]	[0.005]	[52]	[0.007]	
HoH: Elementary school (%)	316	0.703	280	0.686	0.727
	[26]	[0.037]	[30]	[0.035]	
HoH: Lower/Junior High School (%)	316	0.087	280	0.171	0.032**
	[26]	[0.025]	[30]	[0.030]	
HoH: Higher/Senior High School (%)	316	0.015	280	0.027	0.426
	[26]	[0.007]	[30]	[0.012]	
HoH: Technical Training (%)	316	0.001	280	0.002	0.814
	[26]	[0.001]	[30]	[0.002]	
Literacy: No (%)	926	0.302	894	0.269	0.478
	[39]	[0.034]	[52]	[0.033]	
Literacy: Yes, Malagasy (%)	926	0.607	894	0.550	0.257
	[39]	[0.039]	[52]	[0.032]	
Literacy: Yes, Malagasy and French (%)	926	0.085	894	0.165	0.002***
	[39]	[0.014]	[52]	[0.021]	
Literacy: Others (%)	926	0.006	894	0.016	0.269
	[39]	[0.004]	[52]	[0.008]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 62. Socio-demographic characteristics of household members (in %) (part 3)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
House: Own	926	0.901	894	0.923	0.315
	[39]	[0.018]	[52]	[0.014]	
House: Rented	926	0.026	894	0.002	0.159
	[39]	[0.017]	[52]	[0.001]	
House: Borrowed/Family	926	0.072	894	0.069	0.891
	[39]	[0.014]	[52]	[0.013]	
House: Other	926	0.001	894	0.006	0.153
	[39]	[0.001]	[52]	[0.003]	
Years in village	926	18.111	892	17.949	0.912
	[39]	[1.087]	[52]	[0.993]	
Move from: Same Village	925	0.622	893	0.543	0.116
	[39]	[0.039]	[52]	[0.032]	
Move from: Village in same FOKONTANY	925	0.230	893	0.288	0.224
	[39]	[0.028]	[52]	[0.038]	
Move from: Village in same COMMUNE	925	0.078	893	0.070	0.673
	[39]	[0.016]	[52]	[0.012]	
Move from: Village in same PROVINCE	925	0.062	893	0.071	0.723
	[39]	[0.020]	[52]	[0.014]	
Move from: Village in OTHER PROVINCE	925	0.008	893	0.029	0.049**
	[39]	[0.003]	[52]	[0.010]	
Reason: Work opportunity	404	0.181	490	0.240	0.244
	[39]	[0.039]	[47]	[0.031]	
Reason: Lack of land	404	0.067	490	0.157	0.008***
	[39]	[0.016]	[47]	[0.029]	
Reason: Family (wife/husband)	404	0.645	490	0.515	0.097*
	[39]	[0.060]	[47]	[0.050]	
Reason: Social conflicts or violence	404	0.031	490	0.030	0.991
	[39]	[0.015]	[47]	[0.013]	
Reason: Climate/Natural hazards	404	0.019	490	0.021	0.823
	[39]	[0.008]	[47]	[0.007]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 63. Dwelling characteristics (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Roof: Medium value added	926	0.095	894	0.139	0.482
	[39]	[0.026]	[52]	[0.056]	
Roof: High value added	926	0.241	894	0.250	0.840
	[39]	[0.036]	[52]	[0.032]	
Wall: Medium value added	926	0.628	894	0.632	0.944
	[39]	[0.054]	[52]	[0.034]	
Wall: High value added	926	0.072	894	0.047	0.251
	[39]	[0.018]	[52]	[0.011]	
Floor: Little value added	926	0.728	894	0.727	0.989
	[39]	[0.028]	[52]	[0.045]	
Floor: Medium value added	926	0.196	894	0.173	0.638
	[39]	[0.028]	[52]	[0.038]	
Floor: High value added	926	0.077	894	0.100	0.420
	[39]	[0.015]	[52]	[0.024]	
Electricity access	926	0.256	894	0.254	0.973
	[39]	[0.048]	[52]	[0.044]	
Water access	925	0.540	894	0.496	0.558
	[39]	[0.050]	[52]	[0.057]	
Toilet access	925	0.612	894	0.542	0.347
	[39]	[0.047]	[52]	[0.057]	
Reason no toilet: Lack of money	304	0.090	354	0.089	0.980
	[35]	[0.029]	[41]	[0.031]	
Reason no toilet: Not interested	304	0.188	354	0.187	0.978
	[35]	[0.040]	[41]	[0.036]	
Reason no toilet: Not used to	304	0.075	354	0.182	0.056*
	[35]	[0.024]	[41]	[0.050]	
Reason no toilet: Out of use	304	0.205	354	0.206	0.981
	[35]	[0.035]	[41]	[0.032]	
Reason no toilet: Will build later	304	0.237	354	0.253	0.761
	[35]	[0.038]	[41]	[0.036]	
Reason no toilet: Other	304	0.205	354	0.084	0.035**
	[35]	[0.048]	[41]	[0.031]	
Cooking with fuelwood	921	0.981	890	0.991	0.571
	[39]	[0.017]	[52]	[0.005]	
Cooking with charcoal	921	0.043	890	0.032	0.668
	[39]	[0.022]	[52]	[0.010]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 64. Main sources of livelihood/income during the wet season (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Primary source of livelihood: Cultivation	924	0.941	894	0.955	0.593
	[39]	[0.023]	[52]	[0.012]	
Primary source of livelihood: Others	924	0.059	894	0.045	0.593
	[39]	[0.023]	[52]	[0.012]	
Secondary source of livelihood: Herding	824	0.766	821	0.843	0.115
	[39]	[0.040]	[52]	[0.028]	
Secondary source of livelihood: Daily worker	824	0.083	821	0.073	0.705
	[39]	[0.019]	[52]	[0.017]	
Secondary source of livelihood: Others	824	0.151	821	0.084	0.057*
	[39]	[0.031]	[52]	[0.017]	
Tertiary source of livelihood: Herding	330	0.151	306	0.141	0.835
	[39]	[0.039]	[41]	[0.025]	
Tertiary source of livelihood: Fishing	330	0.041	306	0.037	0.874
	[39]	[0.017]	[41]	[0.020]	
Tertiary source of livelihood: Collecting fruits/plants	330	0.135	306	0.175	0.645
	[39]	[0.051]	[41]	[0.072]	
Tertiary source of livelihood: Handcrafter	330	0.153	306	0.112	0.555
	[39]	[0.049]	[41]	[0.050]	
Tertiary source of livelihood: Merchant	330	0.067	306	0.100	0.262
	[39]	[0.019]	[41]	[0.022]	
Tertiary source of livelihood: Daily worker	330	0.317	306	0.226	0.246
	[39]	[0.056]	[41]	[0.056]	
Tertiary source of livelihood: Others	330	0.136	306	0.209	0.160
	[39]	[0.035]	[41]	[0.037]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 65. Main sources of livelihood/income during the dry season (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Primary source of livelihood: Cultivation	925	0.920	894	0.953	0.298
	[39]	[0.030]	[52]	[0.011]	
Primary source of livelihood: Others	925	0.080	894	0.047	0.298
	[39]	[0.030]	[52]	[0.011]	
Secondary source of livelihood: Herding	813	0.775	811	0.849	0.126
	[39]	[0.040]	[52]	[0.027]	
Secondary source of livelihood: Daily worker	813	0.073	811	0.054	0.413
	[39]	[0.019]	[52]	[0.014]	
Secondary source of livelihood: Others	813	0.152	811	0.097	0.114
	[39]	[0.029]	[52]	[0.019]	
Tertiary source of livelihood: Herding	326	0.157	295	0.124	0.474
	[39]	[0.035]	[41]	[0.031]	
Tertiary source of livelihood: Fishing	326	0.037	295	0.041	0.871
	[39]	[0.016]	[41]	[0.019]	
Tertiary source of livelihood: Collecting fruits/plants	326	0.140	295	0.188	0.592
	[39]	[0.051]	[41]	[0.075]	
Tertiary source of livelihood: Handcrafter	326	0.135	295	0.100	0.575
	[39]	[0.046]	[41]	[0.043]	
Tertiary source of livelihood: Merchant	326	0.058	295	0.098	0.191
	[39]	[0.019]	[41]	[0.024]	
Tertiary source of livelihood: Daily worker	326	0.350	295	0.227	0.152
	[39]	[0.068]	[41]	[0.052]	
Tertiary source of livelihood: Others	326	0.123	295	0.222	0.052*
	[39]	[0.034]	[41]	[0.038]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 66. The three most important crop grown by the household (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Crop 1: Cassava	914	0.061	887	0.089	0.326
	[39]	[0.017]	[52]	[0.024]	
Crop 1: Rice	914	0.847	887	0.869	0.553
	[39]	[0.027]	[52]	[0.027]	
Crop 1: Others	914	0.092	887	0.042	0.044**
	[39]	[0.022]	[52]	[0.012]	
Crop 2: Cassava	888	0.409	880	0.586	0.013**
	[39]	[0.048]	[51]	[0.051]	
Crop 2: Rice	888	0.058	880	0.079	0.440
	[39]	[0.016]	[51]	[0.022]	
Crop 2: Maize	888	0.134	880	0.105	0.615
	[39]	[0.043]	[51]	[0.041]	
Crop 2: Beans	888	0.052	880	0.082	0.269
	[39]	[0.019]	[51]	[0.019]	
Crop 2: Sweet potatoes	888	0.199	880	0.050	0.004***
	[39]	[0.048]	[51]	[0.017]	
Crop 2: Others	888	0.148	880	0.099	0.277
	[39]	[0.037]	[51]	[0.026]	
Crop 3: Cassava	729	0.297	743	0.151	0.007***
	[39]	[0.043]	[50]	[0.031]	
Crop 3: Maize	729	0.073	743	0.099	0.326
	[39]	[0.016]	[50]	[0.022]	
Crop 3: Bananas	729	0.115	743	0.181	0.145
	[39]	[0.027]	[50]	[0.036]	
Crop 3: Beans	729	0.125	743	0.116	0.844
	[39]	[0.035]	[50]	[0.025]	
Crop 3: Sugarcane	729	0.038	743	0.055	0.427
	[39]	[0.014]	[50]	[0.016]	
Crop 3: Sweet potatoes	729	0.237	743	0.258	0.734
	[39]	[0.040]	[50]	[0.046]	
Crop 3: Taro	729	0.023	743	0.045	0.075*
	[39]	[0.007]	[50]	[0.010]	
Crop 3: Others	729	0.093	743	0.096	0.914
	[39]	[0.019]	[50]	[0.016]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 67. The three most important livestock/domestic animals (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Livestock 1: Cattle	730	0.313	794	0.370	0.428
	[39]	[0.048]	[52]	[0.054]	
Livestock 1: Pigs	730	0.145	794	0.118	0.395
	[39]	[0.016]	[52]	[0.027]	
Livestock 1: Chicken	730	0.505	794	0.485	0.782
	[39]	[0.053]	[52]	[0.048]	
Livestock 1: Others	730	0.036	794	0.026	0.398
	[39]	[0.010]	[52]	[0.007]	
Livestock 2: Cattle	439	0.031	511	0.058	0.191
	[39]	[0.015]	[48]	[0.014]	
Livestock 2: Pigs	439	0.331	511	0.274	0.429
	[39]	[0.048]	[48]	[0.053]	
Livestock 2: Chicken	439	0.431	511	0.467	0.577
	[39]	[0.033]	[48]	[0.057]	
Livestock 2: Ducks	439	0.091	511	0.078	0.715
	[39]	[0.029]	[48]	[0.021]	
Livestock 2: Goos	439	0.027	511	0.033	0.679
	[39]	[0.009]	[48]	[0.010]	
Livestock 2: Dokotra	439	0.062	511	0.050	0.525
	[39]	[0.010]	[48]	[0.016]	
Livestock 2: Others	439	0.028	511	0.041	0.423
	[39]	[0.009]	[48]	[0.012]	
Livestock 3: Cattle	171	0.061	214	0.043	0.472
	[33]	[0.020]	[44]	[0.015]	
Livestock 3: Pigs	171	0.070	214	0.096	0.411
	[33]	[0.019]	[44]	[0.025]	
Livestock 3: Chicken	171	0.481	214	0.432	0.637
	[33]	[0.051]	[44]	[0.091]	
Livestock 3: Ducks	171	0.183	214	0.204	0.672
	[33]	[0.030]	[44]	[0.042]	
Livestock 3: Goos	171	0.037	214	0.021	0.363
	[33]	[0.014]	[44]	[0.010]	
Livestock 3: Dokotra	171	0.106	214	0.123	0.750
	[33]	[0.033]	[44]	[0.043]	
Livestock 3: Others	171	0.063	214	0.081	0.653
	[33]	[0.025]	[44]	[0.031]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 68. The three most important forest and tree products (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Forest & Tree Product 1: Timber	548	0.172	720	0.175	0.940
	[37]	[0.043]	[48]	[0.028]	
Forest & Tree Product 1: Firewood	548	0.572	720	0.536	0.610
	[37]	[0.040]	[48]	[0.059]	
Forest & Tree Product 1: Leaves for medicines	548	0.135	720	0.213	0.226
	[37]	[0.027]	[48]	[0.058]	
Forest & Tree Product 1: Others	548	0.121	720	0.076	0.191
	[37]	[0.029]	[48]	[0.019]	
Forest & Tree Product 2: Timber	247	0.215	367	0.267	0.459
	[23]	[0.052]	[40]	[0.049]	
Forest & Tree Product 2: Firewood	247	0.314	367	0.358	0.542
	[23]	[0.042]	[40]	[0.058]	
Forest & Tree Product 2: Leaves for medicines	247	0.172	367	0.111	0.250
	[23]	[0.042]	[40]	[0.031]	
Forest & Tree Product 2: Coffee	247	0.118	367	0.110	0.860
	[23]	[0.037]	[40]	[0.029]	
Forest & Tree Product 2: Others	247	0.181	367	0.153	0.625
	[23]	[0.042]	[40]	[0.040]	
Forest & Tree Product 3: Timber	102	0.110	130	0.099	0.815
	[15]	[0.043]	[28]	[0.022]	
Forest & Tree Product 3: Firewood	102	0.240	130	0.233	0.936
	[15]	[0.068]	[28]	[0.051]	
Forest & Tree Product 3: Leaves for medicines	102	0.196	130	0.116	0.338
	[15]	[0.065]	[28]	[0.054]	
Forest & Tree Product 3: Leaves for ripening fruits	102	0.050	130	0.080	0.458
	[15]	[0.023]	[28]	[0.032]	
Forest & Tree Product 3: Coffee	102	0.188	130	0.319	0.352
	[15]	[0.094]	[28]	[0.105]	
Forest & Tree Product 3: wild roots	102	0.133	130	0.084	0.451
	[15]	[0.055]	[28]	[0.034]	
Forest & Tree Product 3: Others	102	0.083	130	0.070	0.838
	[15]	[0.058]	[28]	[0.035]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 69. Total production and use of the three most important crops (in kg)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Crop 1 production	919	576.374	887	814.408	0.002***
	[39]	[47.137]	[52]	[57.097]	
Crop 1 consumption	919	475.596	887	597.587	0.023**
	[39]	[38.239]	[52]	[36.809]	
Crop 1 selling	919	71.973	887	164.810	0.002***
	[39]	[15.700]	[52]	[25.128]	
Crop 1 storage	919	24.650	886	49.143	0.050*
	[39]	[5.318]	[52]	[11.194]	
Crop 2 production	893	1097.260	873	1183.769	0.859
	[39]	[255.706]	[51]	[416.093]	
Crop 2 consumption	892	890.155	873	980.072	0.853
	[39]	[258.115]	[51]	[410.123]	
Crop 2 selling	892	195.134	873	172.504	0.727
	[39]	[50.897]	[51]	[40.479]	
Crop 2 storage	892	12.191	873	30.978	0.271
	[39]	[5.887]	[51]	[15.985]	
Crop 3 production	737	922.482	729	3720.949	0.346
	[39]	[334.503]	[50]	[2947.099]	
Crop 3 consumption	737	481.295	729	3500.258	0.308
	[39]	[83.448]	[50]	[2958.023]	
Crop 3 selling	736	438.328	729	165.847	0.401
	[39]	[320.698]	[50]	[55.239]	
Crop 3 storage	736	3.373	730	2.702	0.616
	[39]	[1.153]	[50]	[0.680]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 70. Total production and use of the three most important livestock and domestic animals (in kg)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Animal 1 production	737	9.962	787	14.453	0.011**
	[39]	[1.057]	[52]	[1.385]	
Animal 1 consumption	736	2.029	787	4.136	0.049**
	[39]	[0.404]	[52]	[0.981]	
Animal 1 selling	736	2.023	787	2.676	0.211
	[39]	[0.384]	[52]	[0.353]	
Animal 1 storage	737	4.836	787	6.222	0.019**
	[39]	[0.382]	[52]	[0.438]	
Animal 2 production	450	9.417	504	13.032	0.051*
	[39]	[0.992]	[48]	[1.540]	
Animal 2 consumption	449	1.603	503	3.557	0.052*
	[39]	[0.274]	[48]	[0.959]	
Animal 2 selling	450	1.510	502	2.370	0.100
	[39]	[0.273]	[48]	[0.443]	
Animal 2 storage	449	4.823	500	5.859	0.219
	[39]	[0.474]	[48]	[0.696]	
Animal 3 production	181	13.272	225	13.908	0.867
	[32]	[3.652]	[43]	[1.081]	
Animal 3 consumption	180	4.931	223	2.628	0.423
	[32]	[2.776]	[43]	[0.775]	
Animal 3 selling	180	2.379	225	3.161	0.459
	[32]	[0.894]	[44]	[0.567]	
Animal 3 storage	180	5.741	224	7.722	0.204
	[32]	[1.264]	[43]	[0.906]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 71. Total production and use of the three most important forest and tree products (in kg)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Forest 1 production	539	388.274	707	310.499	0.575
	[36]	[113.900]	[48]	[80.076]	
Forest 1 consumption	535	297.117	703	283.098	0.893
	[36]	[68.734]	[49]	[78.935]	
Forest 1 selling	535	44.711	705	45.128	0.990
	[36]	[25.932]	[49]	[20.668]	
Forest 1 storage	535	46.560	703	20.576	0.563
	[36]	[41.383]	[49]	[17.810]	
Forest 2 production	260	220.050	386	464.970	0.297
	[26]	[76.332]	[46]	[221.253]	
Forest 2 consumption	259	178.365	389	270.529	0.269
	[25]	[58.655]	[45]	[59.260]	
Forest 2 selling	256	43.265	387	16.733	0.373
	[25]	[29.138]	[45]	[6.978]	
Forest 2 storage	256	0.135	382	3.831	0.049**
	[25]	[0.096]	[45]	[1.851]	
Forest 3 production	117	140.609	147	2738.214	0.269
	[18]	[77.152]	[31]	[2329.497]	
Forest 3 consumption	116	128.919	147	2726.054	0.268
	[18]	[74.914]	[31]	[2325.727]	
Forest 3 selling	116	12.096	147	12.132	0.997
	[18]	[7.330]	[31]	[4.613]	
Forest 3 storage	116	0.000	141	0.312	0.277
	[18]	[0.000]	[31]	[0.285]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 72. Land ownership and food security

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Total land owned (ha)	924	2.065	889	2.514	0.217
	[39]	[0.298]	[52]	[0.208]	
Total land rented (ha)	924	0.062	889	0.086	0.608
	[39]	[0.037]	[52]	[0.029]	
Total land communal (ha)	923	0.283	889	0.331	0.680
	[39]	[0.091]	[52]	[0.074]	
Total land state owned (ha)	923	0.024	889	0.301	0.132
	[39]	[0.012]	[52]	[0.182]	
Food security: Same condition (%)	906	0.151	880	0.155	0.883
	[39]	[0.024]	[52]	[0.020]	
Security food: Better off (%)	906	0.376	880	0.441	0.229
	[39]	[0.044]	[52]	[0.032]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 73. Changes that have negatively impacted households' livelihood in the last 12 months (in %)

Variable	N/[Clusters	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Low price crops	926	0.660	894	0.745	0.157
	[39]	[0.036]	[52]	[0.047]	
Low demand crops	926	0.310	894	0.382	0.210
	[39]	[0.031]	[52]	[0.048]	
Access to inputs	926	0.573	894	0.701	0.014**
	[39]	[0.039]	[52]	[0.033]	
Access to markets	926	0.503	894	0.534	0.608
	[39]	[0.035]	[52]	[0.051]	
Restrictive rules	926	0.135	893	0.147	0.766
	[39]	[0.027]	[52]	[0.030]	
Unpredictable rainfall	925	0.622	892	0.777	0.019**
	[39]	[0.056]	[52]	[0.033]	
Less rainfall	925	0.451	894	0.503	0.397
	[39]	[0.045]	[52]	[0.043]	
Droughts intensity	926	0.580	894	0.526	0.421
	[39]	[0.043]	[52]	[0.052]	
Floods frequency	926	0.550	894	0.586	0.522
	[39]	[0.043]	[52]	[0.036]	
Floods intensity	926	0.632	894	0.602	0.685
	[39]	[0.066]	[52]	[0.034]	
Wind/cyclones frequency	925	0.641	894	0.553	0.194
	[39]	[0.053]	[52]	[0.043]	
Wind/cyclone intensity	925	0.727	894	0.624	0.096*
	[39]	[0.046]	[52]	[0.041]	
Higher temperatures	926	0.474	894	0.465	0.876
	[39]	[0.044]	[52]	[0.041]	
Hail frequency	926	0.380	894	0.377	0.955
	[39]	[0.031]	[52]	[0.047]	
Frost frequency	925	0.240	894	0.309	0.278
	[39]	[0.045]	[52]	[0.045]	
Land less productive	926	0.618	894	0.596	0.654
	[39]	[0.028]	[52]	[0.041]	
Land scarcity	925	0.480	894	0.502	0.593
	[39]	[0.031]	[52]	[0.028]	
Labour too expensive	926	0.602	894	0.657	0.277
	[39]	[0.033]	[52]	[0.039]	
Labour scarcity	926	0.142	894	0.151	0.798
	[39]	[0.022]	[52]	[0.027]	
Plants pests/diseases	922	0.881	892	0.892	0.716
	[39]	[0.021]	[52]	[0.022]	
New plants diseases	926	0.461	894	0.503	0.522
	[39]	[0.049]	[52]	[0.044]	
More human diseases	926	0.655	894	0.592	0.256
	[39]	[0.034]	[52]	[0.043]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 74. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Low price to sell agricultural products: Top 1	631	0.565	643	0.637	0.210
	[39]	[0.039]	[51]	[0.043]	
Low price to sell agricultural products: Top 2	631	0.321	643	0.279	0.439
	[39]	[0.044]	[51]	[0.030]	
Low price to sell agricultural products: Top 3	631	0.115	643	0.083	0.232
	[39]	[0.020]	[51]	[0.017]	
Low demand for agricultural products: Top 1	204	0.141	266	0.132	0.802
	[38]	[0.024]	[37]	[0.029]	
Low demand for agricultural products: Top 2	204	0.475	266	0.507	0.575
	[38]	[0.039]	[37]	[0.041]	
Low demand for agricultural products: Top 3	204	0.384	266	0.361	0.738
	[38]	[0.048]	[37]	[0.045]	
Difficult access to agricultural inputs: Top 1	544	0.437	579	0.383	0.449
	[39]	[0.052]	[52]	[0.049]	
Difficult access to agricultural inputs: Top 2	544	0.364	579	0.302	0.177
	[39]	[0.034]	[52]	[0.032]	
Difficult access to agricultural inputs: Top 3	544	0.199	579	0.316	0.010**
	[39]	[0.030]	[52]	[0.034]	
Low market accessibility: Top 1	509	0.373	419	0.237	0.009***
	[39]	[0.034]	[44]	[0.038]	
Low market accessibility: Top 2	509	0.347	419	0.374	0.562
	[39]	[0.030]	[44]	[0.035]	
Low market accessibility: Top 3	509	0.280	419	0.389	0.087*
	[39]	[0.040]	[44]	[0.049]	
More restrictive rules for land use: Top 1	56	0.338	78	0.221	0.216
	[22]	[0.071]	[25]	[0.061]	
More restrictive rules for land use: Top 2	56	0.266	78	0.390	0.296
	[22]	[0.058]	[25]	[0.103]	
More restrictive rules for land use: Top 3	56	0.396	78	0.389	0.951
	[22]	[0.072]	[25]	[0.092]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 75. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
More unpredictable rainfall: Top 1	231	0.299	338	0.262	0.627
	[36]	[0.060]	[49]	[0.047]	
More unpredictable rainfall: Top 2	231	0.349	338	0.257	0.068*
	[36]	[0.037]	[49]	[0.034]	
More unpredictable rainfall: Top 3	231	0.352	338	0.481	0.048**
	[36]	[0.049]	[49]	[0.042]	
Less overall rainfall: Top 1	225	0.355	251	0.297	0.330
	[36]	[0.044]	[47]	[0.040]	
Less overall rainfall: Top 2	225	0.287	251	0.349	0.233
	[36]	[0.040]	[47]	[0.034]	
Less overall rainfall: Top 3	225	0.358	251	0.354	0.937
	[36]	[0.038]	[47]	[0.038]	
More intense drought: Top 1	486	0.503	371	0.555	0.386
	[37]	[0.045]	[47]	[0.041]	
More intense drought: Top 2	486	0.307	371	0.266	0.317
	[37]	[0.027]	[47]	[0.031]	
More intense drought: Top 3	486	0.190	371	0.179	0.804
	[37]	[0.039]	[47]	[0.027]	
More overall rainfall: Top 1	205	0.288	227	0.357	0.318
	[37]	[0.034]	[37]	[0.060]	
More overall rainfall: Top 2	205	0.393	227	0.329	0.441
	[37]	[0.076]	[37]	[0.033]	
More overall rainfall: Top 3	205	0.319	227	0.314	0.951
	[37]	[0.063]	[37]	[0.071]	
More intense floods: Top 1	349	0.242	333	0.260	0.769
	[38]	[0.047]	[44]	[0.041]	
More intense floods: Top 2	349	0.388	333	0.468	0.147
	[38]	[0.027]	[44]	[0.048]	
More intense floods: Top 3	349	0.371	333	0.272	0.062*
	[38]	[0.035]	[44]	[0.039]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 76. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 3)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
More frequent winds: Top 1	355	0.384	271	0.398	0.824
	[38]	[0.041]	[38]	[0.050]	
More frequent winds: Top 2	355	0.361	271	0.360	0.986
	[38]	[0.042]	[38]	[0.045]	
More frequent winds: Top 3	355	0.256	271	0.243	0.806
	[38]	[0.042]	[38]	[0.034]	
More intense winds: Top 1	419	0.352	279	0.348	0.947
	[38]	[0.035]	[44]	[0.040]	
More intense winds: Top 2	419	0.343	279	0.381	0.374
	[38]	[0.024]	[44]	[0.037]	
More intense winds: Top 3	419	0.306	279	0.270	0.517
	[38]	[0.034]	[44]	[0.043]	
Higher temperatures: Top 1	135	0.250	115	0.194	0.488
	[31]	[0.046]	[32]	[0.066]	
Higher temperatures: Top 2	135	0.352	115	0.241	0.154
	[31]	[0.060]	[32]	[0.049]	
Higher temperatures: Top 3	135	0.399	115	0.565	0.081*
	[31]	[0.059]	[32]	[0.073]	
More frequent hail: Top 1	149	0.261	169	0.375	0.217
	[35]	[0.047]	[37]	[0.079]	
More frequent hail: Top 2	149	0.268	169	0.309	0.469
	[35]	[0.043]	[37]	[0.036]	
More frequent hail: Top 3	149	0.471	169	0.316	0.072*
	[35]	[0.060]	[37]	[0.061]	
More frequent frost: Top 1	63	0.169	77	0.194	0.767
	[24]	[0.051]	[24]	[0.068]	
More frequent frost: Top 2	63	0.354	77	0.277	0.353
	[24]	[0.060]	[24]	[0.056]	
More frequent frost: Top 3	63	0.477	77	0.528	0.639
	[24]	[0.063]	[24]	[0.090]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 77. The three main changes that most severely affected household livelihoods in the last 12 months (in %) (part 4)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Land is less productive: Top 1	624	0.842	540	0.829	0.752
	[39]	[0.026]	[50]	[0.034]	
Land is less productive: Top 2	624	0.155	540	0.171	0.697
	[39]	[0.026]	[50]	[0.034]	
Land is less productive: Top 3	624	0.003	540	0.000	0.328
	[39]	[0.003]	[50]	[0.000]	
Less productive land available: Top 1	499	0.280	460	0.348	0.271
	[38]	[0.044]	[50]	[0.042]	
Less productive land available: Top 2	499	0.716	460	0.651	0.286
	[38]	[0.044]	[50]	[0.042]	
Less productive land available: Top 3	499	0.004	460	0.002	0.537
	[38]	[0.003]	[50]	[0.002]	
Unable to hire labour because expensive:	578	0.967	542	0.960	0.744
	[39]	[0.011]	[48]	[0.016]	
Unable to hire labour because expensive:	578	0.033	542	0.040	0.717
	[39]	[0.011]	[48]	[0.016]	
Unable to hire labour because expensive:	578	0.001	542	0.000	0.327
	[39]	[0.001]	[48]	[0.000]	
Unable to hire labour because unavailable:	146	0.242	114	0.204	0.619
	[35]	[0.045]	[31]	[0.061]	
Unable to hire labour because unavailable:	146	0.758	114	0.796	0.619
	[35]	[0.045]	[31]	[0.061]	
More agriculture pests: Top 1	824	0.561	788	0.643	0.156
	[39]	[0.040]	[52]	[0.042]	
More agriculture pests: Top 2	824	0.355	788	0.307	0.383
	[39]	[0.038]	[52]	[0.039]	
More agriculture pests: Top 3	824	0.084	788	0.050	0.168
	[39]	[0.021]	[52]	[0.014]	
New agriculture pests have come: Top 1	473	0.148	450	0.174	0.522
	[38]	[0.028]	[51]	[0.029]	
New agriculture pests have come: Top 2	473	0.549	450	0.581	0.554
	[38]	[0.033]	[51]	[0.042]	
New agriculture pests have come: Top 3	473	0.303	450	0.245	0.346
	[38]	[0.035]	[51]	[0.050]	
More human diseases: Top 1	644	0.594	568	0.476	0.109
	[38]	[0.055]	[46]	[0.049]	
More human diseases: Top 2	644	0.196	568	0.268	0.137
	[38]	[0.029]	[46]	[0.038]	
More human diseases: Top 3	644	0.209	568	0.256	0.482
	[38]	[0.041]	[46]	[0.053]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 78. The impact of climate-related hazards on households (frequency and year)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cyclone times	925	2.744	891	2.538	0.291
	[39]	[0.167]	[52]	[0.101]	
Cyclone latest year	864	2017.900	808	2017.747	0.011**
	[39]	[0.025]	[52]	[0.053]	
Drought times	926	1.872	893	1.752	0.611
	[39]	[0.161]	[52]	[0.174]	
Drought latest year	768	2017.656	801	2017.350	0.007***
	[39]	[0.059]	[51]	[0.095]	
Flood times	920	1.800	880	1.947	0.483
	[39]	[0.183]	[52]	[0.103]	
Flood latest year	700	2017.842	663	2017.771	0.210
	[39]	[0.039]	[48]	[0.041]	
Hail times	926	0.846	891	0.968	0.440
	[39]	[0.113]	[52]	[0.112]	
Hail latest year	427	2017.752	480	2017.487	0.072*
	[38]	[0.071]	[43]	[0.127]	
Frost times	926	0.800	893	1.018	0.348
	[39]	[0.157]	[52]	[0.171]	
Frost latest year	225	2017.689	289	2017.562	0.317
	[33]	[0.071]	[38]	[0.106]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 79. The impact of climate-related hazards on households (by degree of severity) (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Strong Wind: Severe	854	0.524	776	0.456	0.239
	[39]	[0.039]	[52]	[0.042]	
Strong Wind: Medium	854	0.355	776	0.406	0.262
	[39]	[0.032]	[52]	[0.032]	
Strong Wind: Mild	854	0.122	776	0.139	0.545
	[39]	[0.021]	[52]	[0.019]	
Drought: Severe	727	0.479	719	0.477	0.977
	[38]	[0.052]	[50]	[0.036]	
Drought: Medium	727	0.328	719	0.276	0.220
	[38]	[0.032]	[50]	[0.027]	
Drought: Mild	727	0.194	719	0.247	0.324
	[38]	[0.037]	[50]	[0.040]	
Flood: Severe	621	0.237	561	0.224	0.773
	[39]	[0.034]	[46]	[0.025]	
Flood: Medium	621	0.431	561	0.376	0.303
	[39]	[0.042]	[46]	[0.033]	
Flood: Mild	621	0.332	561	0.399	0.277
	[39]	[0.044]	[46]	[0.043]	
Hail: Severe	198	0.164	224	0.288	0.076*
	[36]	[0.034]	[40]	[0.060]	
Hail: Medium	198	0.322	224	0.253	0.214
	[36]	[0.040]	[40]	[0.039]	
Hail: Mild	198	0.515	224	0.460	0.427
	[36]	[0.044]	[40]	[0.053]	
Frost: Severe	79	0.114	96	0.220	0.265
	[25]	[0.041]	[25]	[0.086]	
Frost: Medium	79	0.416	96	0.363	0.610
	[25]	[0.072]	[25]	[0.077]	
Frost: Mild	79	0.470	96	0.417	0.590
	[25]	[0.069]	[25]	[0.071]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 80. Damages to the dwelling caused by climate-related hazards (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact strong wind on house: Not Damaged	868	0.562	813	0.572	0.843
	[39]	[0.039]	[52]	[0.028]	
Impact strong wind on house: Roof damaged (slightly)	868	0.148	813	0.172	0.484
	[39]	[0.028]	[52]	[0.019]	
Impact strong wind on house: Roof + Walls (Moderately)	868	0.064	813	0.092	0.217
	[39]	[0.012]	[52]	[0.019]	
Impact strong wind on house: Destroyed (Severe)	868	0.103	813	0.092	0.568
	[39]	[0.013]	[52]	[0.012]	
Impact drought on house: Not Damaged	926	0.998	893	0.996	0.543
	[39]	[0.002]	[52]	[0.002]	
Impact drought on house: Roof damaged (slightly)	926	0.002	893	0.002	0.884
	[39]	[0.002]	[52]	[0.001]	
Impact drought on house: Roof + Walls (Moderately)	926	0.000	893	0.000	N/A
	[39]	[0.000]	[52]	[0.000]	
Impact hail on house: Not Damaged	926	0.964	893	0.968	0.841
	[39]	[0.016]	[52]	[0.009]	
Impact hail on house: Roof damaged (slightly)	926	0.032	893	0.023	0.603
	[39]	[0.015]	[52]	[0.007]	
Impact hail on house: Roof + Walls (Moderately)	926	0.000	893	0.002	0.264
	[39]	[0.000]	[52]	[0.002]	
Impact hail on house: Destroyed (Severe)	926	0.003	893	0.006	0.474
	[39]	[0.003]	[52]	[0.003]	
Impact frost on house: Not Damaged	926	1.000	893	0.999	0.311
	[39]	[0.000]	[52]	[0.001]	
Impact frost on house: Roof damaged (slightly)	926	0.000	893	0.001	0.311
	[39]	[0.000]	[52]	[0.001]	
Impact flood on house: Not Damaged	926	0.967	893	0.961	0.645
	[39]	[0.010]	[52]	[0.009]	
Impact flood on house: Roof damaged (slightly)	926	0.007	893	0.015	0.278
	[39]	[0.003]	[52]	[0.007]	
Impact flood on house: Roof + Walls (Moderately)	926	0.008	893	0.013	0.478
	[39]	[0.004]	[52]	[0.006]	
Impact flood on house: Destroyed (Severe)	926	0.007	893	0.004	0.419
	[39]	[0.004]	[52]	[0.002]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 81. Damages to the assets caused by climate-related hazards (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact strong wind on assets: Not Damaged	926	0.863	893	0.900	0.265
	[39]	[0.029]	[52]	[0.016]	
Impact strong wind on assets: Roof damaged (slightly)	926	0.043	893	0.035	0.611
	[39]	[0.014]	[52]	[0.008]	
Impact strong wind on assets: Roof + Walls (Moderately)	926	0.032	893	0.023	0.580
	[39]	[0.014]	[52]	[0.006]	
Impact strong wind on assets: Destroyed (Severe)	926	0.060	893	0.042	0.341
	[39]	[0.015]	[52]	[0.011]	
Impact drought on assets: Not Damaged	926	0.994	893	0.999	0.403
	[39]	[0.006]	[52]	[0.001]	
Impact drought on assets: Roof damaged (slightly)	926	0.006	893	0.000	0.318
	[39]	[0.006]	[52]	[0.000]	
Impact drought on assets: Roof + Walls (Moderately)	926	0.000	893	0.000	0.327
	[39]	[0.000]	[52]	[0.000]	
Impact drought on assets: Destroyed (Severe)	926	0.000	893	0.001	0.313
	[39]	[0.000]	[52]	[0.001]	
Impact hail on assets: Not Damaged	926	0.994	893	0.989	0.442
	[39]	[0.004]	[52]	[0.004]	
Impact hail on assets: Roof damaged (slightly)	926	0.005	893	0.003	0.772
	[39]	[0.003]	[52]	[0.002]	
Impact hail on assets: Roof + Walls (Moderately)	926	0.002	893	0.004	0.414
	[39]	[0.002]	[52]	[0.002]	
Impact hail on assets: Destroyed (Severe)	926	0.000	893	0.003	0.153
	[39]	[0.000]	[52]	[0.002]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 82. Damages to the assets caused by climate-related hazards (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Impact frost on assets: Not Damaged	926	1.000	893	0.999	0.318
	[39]	[0.000]	[52]	[0.001]	
Impact frost on assets: Roof damaged (slightly)	926	0.000	893	0.000	N/A
	[39]	[0.000]	[52]	[0.000]	
Impact frost on assets: Roof + Walls (Moderately)	926	0.000	893	0.001	0.318
	[39]	[0.000]	[52]	[0.001]	
Impact flood on assets: Not Damaged	926	0.971	893	0.981	0.372
	[39]	[0.010]	[52]	[0.006]	
Impact flood on assets: Roof damaged (slightly)	926	0.010	893	0.006	0.320
	[39]	[0.004]	[52]	[0.002]	
Impact flood on assets: Roof + Walls (Moderately)	926	0.004	893	0.006	0.665
	[39]	[0.002]	[52]	[0.003]	
Impact flood on assets: Destroyed (Severe)	926	0.014	893	0.008	0.395
	[39]	[0.006]	[52]	[0.003]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 83. Other damages caused by climate-related hazards (number of days lost)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone transport	926	5.492	893	3.377	0.299
	[39]	[1.897]	[52]	[0.745]	
Damage drought transport	926	0.018	893	0.008	0.395
	[39]	[0.008]	[52]	[0.008]	
Damage hail transport	926	0.025	893	0.020	0.748
	[39]	[0.012]	[52]	[0.010]	
Damage frost transport	926	0.005	893	0.009	0.664
	[39]	[0.003]	[52]	[0.008]	
Damage flood transport	926	3.219	893	2.296	0.443
	[39]	[1.027]	[52]	[0.634]	
Damage cyclone injuries	917	1.349	887	0.818	0.268
	[39]	[0.449]	[52]	[0.170]	
Damage drought injuries	924	0.643	892	0.398	0.444
	[39]	[0.304]	[52]	[0.103]	
Damage hail injuries	923	0.015	892	0.007	0.407
	[39]	[0.010]	[52]	[0.004]	
Damage frost injuries	923	0.190	889	0.245	0.840
	[39]	[0.144]	[52]	[0.228]	
Damage flood injuries	917	0.158	887	0.072	0.230
	[39]	[0.069]	[52]	[0.019]	
Damage cyclone loss of school time	926	3.919	893	2.657	0.019**
	[39]	[0.488]	[52]	[0.206]	
Damage drought lack of school time	926	0.010	893	0.015	0.720
	[39]	[0.009]	[52]	[0.010]	
Damage hail lack of school time	926	0.034	893	0.012	0.154
	[39]	[0.014]	[52]	[0.005]	
Damage frost lack of school time	926	0.009	893	0.008	0.876
	[39]	[0.007]	[52]	[0.006]	
Damage flood lack of school time	926	1.388	893	1.464	0.796
	[39]	[0.229]	[52]	[0.187]	
Damage cyclone cultivation	926	0.529	893	0.577	0.773
	[39]	[0.128]	[52]	[0.112]	
Damage drought cultivation	926	0.017	893	0.020	0.843
	[39]	[0.010]	[52]	[0.014]	
Damage hail cultivation	926	0.007	893	0.045	0.254
	[39]	[0.004]	[52]	[0.033]	
Damage frost cultivation	926	0.000	893	0.032	0.202
	[39]	[0.000]	[52]	[0.025]	
Damage flood cultivation	926	0.155	893	0.470	0.006***
	[39]	[0.039]	[52]	[0.104]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 84. Damages to crop harvest caused by climate-related hazards (% harvest decrease by type of crop)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone crop top 1	926	32.370	893	24.652	0.075*
	[39]	[3.625]	[52]	[2.341]	
Damage drought crop top 1	926	16.826	893	11.276	0.048**
	[39]	[2.230]	[52]	[1.676]	
Damage hail crop top 1	926	4.983	893	4.152	0.574
	[39]	[0.969]	[52]	[1.123]	
Damage frost crop top 1	926	1.808	893	0.880	0.039**
	[39]	[0.332]	[52]	[0.298]	
Damage flood crop top 1	926	14.035	893	13.895	0.963
	[39]	[2.159]	[52]	[2.097]	
Damage cyclone crop top 2	926	24.751	893	19.358	0.154
	[39]	[3.264]	[52]	[1.890]	
Damage drought crop top 2	926	7.306	893	3.983	0.018**
	[39]	[1.167]	[52]	[0.740]	
Damage hail crop top 2	926	3.212	893	3.084	0.901
	[39]	[0.737]	[52]	[0.718]	
Damage frost crop top 2	926	1.856	893	0.875	0.110
	[39]	[0.502]	[52]	[0.349]	
Damage flood crop top 2	926	6.592	893	7.356	0.732
	[39]	[1.305]	[52]	[1.818]	
Damage cyclone crop top 3	926	14.852	893	13.514	0.574
	[39]	[1.757]	[52]	[1.615]	
Damage drought crop top 3	877	5.234	826	3.112	0.067*
	[39]	[0.916]	[52]	[0.697]	
Damage hail crop top 3	926	2.322	893	1.693	0.313
	[39]	[0.508]	[52]	[0.361]	
Damage frost crop top 3	926	0.979	893	1.091	0.851
	[39]	[0.314]	[52]	[0.510]	
Damage flood crop top 3	926	4.261	893	5.053	0.506
	[39]	[0.752]	[52]	[0.926]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 85. Damages to forest products caused by climate-related hazards (% decrease by forest product)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone forest top 1	925	5.723	893	6.442	0.728
	[39]	[1.615]	[52]	[1.297]	
Damage drought forest top 1	926	0.550	893	1.136	0.165
	[39]	[0.234]	[52]	[0.350]	
Damage hail forest top 1	926	0.192	893	0.735	0.138
	[39]	[0.107]	[52]	[0.349]	
Damage frost forest top 1	926	0.117	893	0.379	0.390
	[39]	[0.105]	[52]	[0.286]	
Damage flood forest top 1	925	1.990	893	2.354	0.688
	[39]	[0.596]	[52]	[0.684]	
Damage cyclone forest top 2	926	1.581	891	2.792	0.100
	[39]	[0.472]	[52]	[0.561]	
Damage drought forest top 2	926	0.327	893	0.567	0.395
	[39]	[0.153]	[52]	[0.237]	
Damage hail forest top 2	926	0.046	893	0.207	0.129
	[39]	[0.043]	[52]	[0.096]	
Damage frost forest top 2	926	0.042	893	0.120	0.541
	[39]	[0.042]	[52]	[0.120]	
Damage flood forest top 2	926	0.607	893	1.473	0.322
	[39]	[0.265]	[52]	[0.831]	
Damage cyclone forest top 3	925	0.490	893	1.709	0.020**
	[39]	[0.208]	[52]	[0.475]	
Damage drought forest top 3	926	0.119	893	0.102	0.871
	[39]	[0.075]	[52]	[0.073]	
Damage hail forest top 3	926	0.039	893	0.042	0.946
	[39]	[0.031]	[52]	[0.026]	
Damage frost forest top 3	926	0.000	893	0.054	0.319
	[39]	[0.000]	[52]	[0.054]	
Damage flood forest top 3	926	0.180	893	0.210	0.825
	[39]	[0.105]	[52]	[0.090]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 86. Damages to animal products caused by climate-related hazards (% decrease by animals)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Damage cyclone animals top 1	926	1.920	893	1.512	0.491
	[39]	[0.450]	[52]	[0.387]	
Damage drought animals top 1	926	0.971	893	1.847	0.287
	[39]	[0.401]	[52]	[0.717]	
Damage hail animals top 1	926	0.187	893	0.240	0.770
	[39]	[0.126]	[52]	[0.129]	
Damage frost animals top 1	926	0.021	893	0.549	0.161
	[39]	[0.015]	[52]	[0.374]	
Damage flood animals top 1	926	0.385	893	0.908	0.248
	[39]	[0.139]	[52]	[0.429]	
Damage cyclone animals top 2	926	0.969	893	1.131	0.807
	[39]	[0.359]	[52]	[0.556]	
Damage drought animals top 2	926	0.247	893	0.854	0.123
	[39]	[0.163]	[52]	[0.357]	
Damage hail animals top 2	926	0.113	893	0.080	0.726
	[39]	[0.075]	[52]	[0.054]	
Damage frost animals top 2	926	0.086	893	0.129	0.681
	[39]	[0.069]	[52]	[0.079]	
Damage flood animals top 2	926	0.238	893	0.875	0.254
	[39]	[0.145]	[52]	[0.539]	
Damage cyclone animals top 3	926	0.450	893	0.189	0.455
	[39]	[0.340]	[52]	[0.085]	
Damage drought animals top 3	926	0.242	893	0.101	0.357
	[39]	[0.136]	[52]	[0.072]	
Damage hail animals top 3	926	0.000	893	0.001	0.327
	[39]	[0.000]	[52]	[0.001]	
Damage frost animals top 3	926	0.003	893	0.029	0.212
	[39]	[0.003]	[52]	[0.021]	
Damage flood animals top 3	926	0.005	893	0.269	0.268
	[39]	[0.004]	[52]	[0.237]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 87. Number of days in the past 12 months during which the household lacked food and water

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Lack of food days	925	13.496	892	15.347	0.673
	[39]	[2.411]	[52]	[3.673]	
Lack of water domestic days	923	7.106	893	8.519	0.541
	[39]	[1.633]	[52]	[1.645]	
Lack of water for agriculture	914	28.049	893	27.043	0.839
	[39]	[2.767]	[52]	[4.130]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 88. Strategies used to reduce sensitivity to climate-related hazards (for crops) (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response soil conservation used	926	0.418	894	0.461	0.554
	[39]	[0.046]	[52]	[0.055]	
Response agroforestry used	926	0.382	894	0.468	0.156
	[39]	[0.039]	[52]	[0.046]	
Response terracing used	925	0.217	894	0.245	0.622
	[39]	[0.042]	[52]	[0.039]	
Response resistant crops	926	0.279	894	0.317	0.467
	[39]	[0.033]	[52]	[0.040]	
Response multi crops description	926	0.541	894	0.489	0.372
	[39]	[0.045]	[52]	[0.037]	
Response irrigation description	926	0.612	893	0.683	0.194
	[39]	[0.043]	[52]	[0.033]	
Response off season rice	926	0.280	894	0.323	0.589
	[39]	[0.057]	[52]	[0.056]	
Response storage	926	0.181	894	0.290	0.008***
	[39]	[0.033]	[52]	[0.024]	
Response pest management	926	0.252	894	0.303	0.246
	[39]	[0.031]	[52]	[0.031]	
Response saving groups	926	0.080	894	0.126	0.227
	[39]	[0.019]	[52]	[0.033]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 89. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response soil conservation cyclone	224	0.618	257	0.692	0.389
	[32]	[0.069]	[40]	[0.052]	
Response soil conservation flood	178	0.737	211	0.710	0.769
	[26]	[0.060]	[37]	[0.071]	
Response soil conservation drought	176	0.767	235	0.715	0.551
	[33]	[0.059]	[43]	[0.064]	
Response soil conservation hail	114	0.241	142	0.265	0.819
	[22]	[0.065]	[28]	[0.084]	
Response soil conservation frost	99	0.346	156	0.346	1.000
	[20]	[0.087]	[29]	[0.077]	
Response agroforestry cycl	282	0.617	334	0.593	0.737
	[35]	[0.059]	[41]	[0.037]	
Response agroforestry flood	240	0.582	272	0.542	0.681
	[31]	[0.070]	[39]	[0.066]	
Response agroforestry drought	235	0.702	287	0.716	0.843
	[38]	[0.061]	[44]	[0.040]	
Response agroforestry hail	126	0.294	172	0.173	0.371
	[27]	[0.101]	[28]	[0.090]	
Response agroforestry frost	87	0.417	188	0.168	0.081*
	[22]	[0.118]	[28]	[0.076]	
Response terracing cyclone	216	0.395	225	0.365	0.752
	[30]	[0.073]	[35]	[0.058]	
Response terracing flood	180	0.485	192	0.568	0.534
	[26]	[0.102]	[34]	[0.084]	
Response terracing drought	177	0.330	185	0.404	0.497
	[29]	[0.079]	[36]	[0.076]	
Response terracing hail	105	0.118	122	0.109	0.919
	[21]	[0.063]	[20]	[0.050]	
Response terracing frost	84	0.141	143	0.130	0.891
	[18]	[0.065]	[23]	[0.053]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 90. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response resistant crops cyclone	268	0.622	244	0.632	0.901
	[35]	[0.066]	[42]	[0.045]	
Response resistant crops flood	194	0.573	186	0.566	0.944
	[28]	[0.072]	[38]	[0.069]	
Response resistant crops drought	192	0.557	200	0.645	0.320
	[33]	[0.069]	[41]	[0.054]	
Response resistant crops hail	101	0.293	100	0.316	0.844
	[20]	[0.088]	[22]	[0.076]	
Response resistant crops frost	74	0.403	128	0.364	0.743
	[14]	[0.104]	[27]	[0.062]	
Response multi crops cyclone	409	0.610	374	0.589	0.765
	[37]	[0.054]	[45]	[0.044]	
Response multi crops flood	271	0.546	255	0.528	0.862
	[32]	[0.070]	[39]	[0.071]	
Response multi crops drought	258	0.589	247	0.584	0.947
	[35]	[0.065]	[43]	[0.046]	
Response multi crops hail	149	0.334	161	0.257	0.474
	[27]	[0.086]	[25]	[0.065]	
Response multi crops frost	114	0.386	173	0.233	0.211
	[23]	[0.103]	[27]	[0.066]	
Response irrigation cyclone	363	0.720	425	0.735	0.823
	[35]	[0.056]	[42]	[0.040]	
Response irrigation flood	400	0.802	447	0.805	0.969
	[39]	[0.054]	[42]	[0.047]	
Response irrigation drought	396	0.732	395	0.782	0.439
	[39]	[0.052]	[45]	[0.040]	
Response irrigation hail	168	0.286	212	0.220	0.614
	[27]	[0.090]	[28]	[0.094]	
Response irrigation frost	128	0.408	213	0.232	0.255
	[24]	[0.125]	[28]	[0.091]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 91. Strategies used to reduce sensitivity to specific climate-related hazards, for crops (in %) (part 3)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response off season rice cyclone	219	0.557	235	0.464	0.492
	[29]	[0.102]	[39]	[0.091]	
Response off season rice flood	191	0.585	164	0.461	0.388
	[25]	[0.112]	[34]	[0.090]	
Response off season rice drought	326	0.682	284	0.651	0.769
	[29]	[0.073]	[40]	[0.074]	
Response off season rice hail	101	0.405	99	0.454	0.804
	[15]	[0.144]	[21]	[0.135]	
Response off season rice frost	88	0.551	114	0.413	0.451
	[15]	[0.139]	[22]	[0.120]	
Response storage cyclone	217	0.477	288	0.480	0.975
	[29]	[0.060]	[46]	[0.069]	
Response storage flood	166	0.412	223	0.448	0.679
	[25]	[0.051]	[40]	[0.069]	
Response storage drought	159	0.342	209	0.432	0.286
	[28]	[0.043]	[38]	[0.073]	
Response storage hail	94	0.238	131	0.196	0.579
	[20]	[0.057]	[28]	[0.050]	
Response storage frost	74	0.268	137	0.165	0.123
	[16]	[0.038]	[26]	[0.054]	
Response pest management	222	0.325	248	0.327	0.983
	[34]	[0.065]	[39]	[0.052]	
Response pest management	182	0.319	194	0.333	0.886
	[30]	[0.074]	[36]	[0.062]	
Response pest management	251	0.496	289	0.564	0.550
	[38]	[0.076]	[43]	[0.085]	
Response pest management hail	116	0.170	118	0.090	0.143
	[26]	[0.046]	[25]	[0.029]	
Response pest management frost	90	0.221	137	0.188	0.703
	[20]	[0.062]	[27]	[0.063]	
Response saving groups cyclone	158	0.191	183	0.247	0.593
	[25]	[0.071]	[35]	[0.080]	
Response saving groups flood	130	0.189	135	0.328	0.303
	[21]	[0.079]	[31]	[0.109]	
Response saving groups drought	143	0.183	138	0.150	0.731
	[18]	[0.080]	[28]	[0.053]	
Response saving groups hail	85	0.055	83	0.142	0.210
	[18]	[0.028]	[19]	[0.063]	
Response saving groups frost	68	0.052	109	0.123	0.225
	[14]	[0.024]	[22]	[0.054]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 92. Top three strategies used to reduce sensitivity to climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Soil conservation: Top 1	246	0.435	284	0.422	0.884
	[34]	[0.060]	[42]	[0.074]	
Soil conservation: Top 2	246	0.408	284	0.300	0.086*
	[34]	[0.051]	[42]	[0.035]	
Soil conservation: Top 3	246	0.157	284	0.279	0.064*
	[34]	[0.030]	[42]	[0.057]	
Agroforestry and tree planting: Top 1	204	0.237	225	0.331	0.134
	[38]	[0.040]	[39]	[0.048]	
Agroforestry and tree planting: Top 2	204	0.390	225	0.346	0.470
	[38]	[0.048]	[39]	[0.039]	
Agroforestry and tree planting: Top 3	204	0.373	225	0.324	0.394
	[38]	[0.037]	[39]	[0.044]	
Contour plowing/terracing: Top 1	122	0.425	129	0.306	0.098*
	[28]	[0.057]	[31]	[0.043]	
Contour plowing/terracing: Top 2	122	0.352	129	0.418	0.230
	[28]	[0.031]	[31]	[0.045]	
Contour plowing/terracing: Top 3	122	0.222	129	0.276	0.415
	[28]	[0.047]	[31]	[0.045]	
Changed to more resistant crops: Top 1	147	0.482	135	0.372	0.110
	[28]	[0.058]	[37]	[0.036]	
Changed to more resistant crops: Top 2	147	0.250	135	0.325	0.167
	[28]	[0.043]	[37]	[0.032]	
Changed to more resistant crops: Top 3	147	0.268	135	0.303	0.652
	[28]	[0.059]	[37]	[0.050]	
Multi cropping system: Top 1	350	0.291	256	0.303	0.854
	[36]	[0.046]	[37]	[0.046]	
Multi cropping system: Top 2	350	0.411	256	0.326	0.044**
	[36]	[0.026]	[37]	[0.032]	
Multi cropping system: Top 3	350	0.298	256	0.370	0.205
	[36]	[0.037]	[37]	[0.044]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 93. Top three strategies used to reduce sensitivity to climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Irrigation systems: Top 1	435	0.551	503	0.557	0.940
	[39]	[0.065]	[47]	[0.057]	
Irrigation systems: Top 2	435	0.264	503	0.329	0.378
	[39]	[0.052]	[47]	[0.052]	
Irrigation systems: Top 3	435	0.185	503	0.114	0.062*
	[39]	[0.033]	[47]	[0.019]	
Off season rice cultivation: Top 1	294	0.423	260	0.405	0.872
	[25]	[0.077]	[33]	[0.075]	
Off season rice cultivation: Top 2	294	0.342	260	0.319	0.751
	[25]	[0.045]	[33]	[0.057]	
Off season rice cultivation: Top 3	294	0.235	260	0.276	0.609
	[25]	[0.059]	[33]	[0.053]	
Improvement/creation of grain storage: Top 1	99	0.233	107	0.113	0.117
	[25]	[0.067]	[36]	[0.036]	
Improvement/creation of grain storage: Top 2	99	0.335	107	0.381	0.606
	[25]	[0.077]	[36]	[0.047]	
Improvement/creation of grain storage: Top 3	99	0.432	107	0.506	0.431
	[25]	[0.080]	[36]	[0.050]	
Integrated pest management: Top 1	123	0.315	169	0.296	0.711
	[30]	[0.041]	[40]	[0.030]	
Integrated pest management: Top 2	123	0.214	169	0.392	0.011**
	[30]	[0.055]	[40]	[0.041]	
Integrated pest management: Top 3	123	0.471	169	0.313	0.053*
	[30]	[0.068]	[40]	[0.043]	
Establishment of saving groups: Top 1	31	0.173	23	0.114	0.656
	[15]	[0.104]	[13]	[0.079]	
Establishment of saving groups: Top 2	31	0.427	23	0.297	0.597
	[15]	[0.155]	[13]	[0.190]	
Establishment of saving groups: Top 3	31	0.400	23	0.588	0.425
	[15]	[0.113]	[13]	[0.206]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 94. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Soil conservation: lack of money	618	0.135	524	0.198	0.122
	[39]	[0.022]	[47]	[0.034]	
Soil conservation: lack of knowledge/skills	618	0.442	524	0.447	0.944
	[39]	[0.053]	[47]	[0.047]	
Soil conservation: lack of interest/not useful	618	0.201	524	0.164	0.440
	[39]	[0.042]	[47]	[0.022]	
Soil conservation: others	618	0.223	524	0.191	0.424
	[39]	[0.029]	[47]	[0.026]	
Agroforestry & tree planting: lack of knowledge/skills	604	0.304	508	0.478	0.025**
	[39]	[0.054]	[51]	[0.054]	
Agroforestry & tree planting: lack of interest/not useful	604	0.247	508	0.151	0.015**
	[39]	[0.027]	[51]	[0.028]	
Agroforestry & tree planting: lack of time	604	0.196	508	0.139	0.134
	[39]	[0.029]	[51]	[0.024]	
Agroforestry & tree planting: others	604	0.253	508	0.232	0.653
	[39]	[0.027]	[51]	[0.039]	
Contour plowing/terracing: lack of knowledge/skills	763	0.428	676	0.557	0.053*
	[39]	[0.056]	[49]	[0.036]	
Contour plowing/terracing: lack of interest/not useful	763	0.228	676	0.221	0.909
	[39]	[0.036]	[49]	[0.043]	
Contour plowing/terracing: others	763	0.345	676	0.222	0.061*
	[39]	[0.056]	[49]	[0.033]	
Changed to more resistant crops: lack of money	674	0.229	636	0.278	0.376
	[39]	[0.042]	[49]	[0.035]	
Changed to more resistant crops: lack of knowledge/skills	674	0.428	636	0.425	0.962
	[39]	[0.046]	[49]	[0.042]	
Changed to more resistant crops: lack of technology/tools	674	0.031	636	0.029	0.907
	[39]	[0.011]	[49]	[0.010]	
Changed to more resistant crops: lack of interest/not useful	674	0.143	636	0.143	0.999
	[39]	[0.025]	[49]	[0.031]	
Changed to more resistant crops: others	674	0.169	636	0.124	0.323
	[39]	[0.031]	[49]	[0.032]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 95. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Multi cropping system: lack of knowledge/skills	405	0.283	474	0.366	0.246
	[39]	[0.050]	[49]	[0.051]	
Multi cropping system: lack of interest/not useful	405	0.272	474	0.353	0.195
	[39]	[0.035]	[49]	[0.052]	
Multi cropping system: others	405	0.445	474	0.281	0.040**
	[39]	[0.065]	[49]	[0.046]	
Irrigation systems: lack of money	406	0.033	277	0.119	0.004***
	[38]	[0.012]	[44]	[0.026]	
Irrigation systems: lack of knowledge/skills	406	0.249	277	0.247	0.985
	[38]	[0.047]	[44]	[0.049]	
Irrigation systems: lack of technology/tools	406	0.166	277	0.243	0.336
	[38]	[0.042]	[44]	[0.067]	
Irrigation systems: lack of interest/not useful	406	0.251	277	0.135	0.018**
	[38]	[0.037]	[44]	[0.031]	
Irrigation systems: lack of time	406	0.076	277	0.112	0.264
	[38]	[0.016]	[44]	[0.028]	
Irrigation systems: others	406	0.225	277	0.143	0.141
	[38]	[0.043]	[44]	[0.034]	
Off season rice cultivation: lack of knowledge/skills	553	0.063	537	0.178	0.006***
	[38]	[0.021]	[49]	[0.036]	
Off season rice cultivation: lack of interest/not useful	553	0.132	537	0.241	0.054*
	[38]	[0.037]	[49]	[0.042]	
Off season rice cultivation: lack of time	553	0.029	537	0.090	0.046**
	[38]	[0.011]	[49]	[0.028]	
Off season rice cultivation: others	553	0.776	537	0.492	0.004***
	[38]	[0.062]	[49]	[0.073]	
Improvement/creation of grain storage: lack of money	675	0.248	618	0.417	0.005***
	[39]	[0.043]	[50]	[0.041]	
Improvement/creation of grain storage: lack of knowledge/skills	675	0.090	618	0.109	0.550
	[39]	[0.022]	[50]	[0.024]	
Improvement/creation of grain storage: lack of interest/not useful	675	0.153	618	0.180	0.566
	[39]	[0.035]	[50]	[0.031]	
Improvement/creation of grain storage: others	675	0.509	618	0.294	0.012**

	[39]	[0.070]	[50]	[0.047]

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 96. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for crops (in %) (part 3)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Integrated pest management: lack of money	697	0.529	595	0.533	0.934
	[39]	[0.037]	[48]	[0.036]	
Integrated pest management: lack of knowledge/skills	697	0.321	595	0.310	0.824
	[39]	[0.034]	[48]	[0.037]	
Integrated pest management: lack of interest/not useful	697	0.068	595	0.060	0.749
	[39]	[0.023]	[48]	[0.013]	
Integrated pest management: others	697	0.082	595	0.097	0.618
	[39]	[0.020]	[48]	[0.024]	
Establishment of saving groups: lack of money	835	0.202	791	0.360	0.016**
	[39]	[0.037]	[52]	[0.052]	
Establishment of saving groups: lack of knowledge/skills	835	0.113	791	0.131	0.624
	[39]	[0.023]	[52]	[0.028]	
Establishment of saving groups: lack of interest/not useful	835	0.218	791	0.294	0.243
	[39]	[0.048]	[52]	[0.044]	
Establishment of saving groups: others	835	0.467	791	0.215	0.002***
	[39]	[0.070]	[52]	[0.033]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 97. Strategies used to reduce sensitivity to specific climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Response animal production	922	0.323	885	0.419	0.114
	[39]	[0.039]	[52]	[0.046]	
Response animal production cyclone	239	0.569	302	0.639	0.282
	[35]	[0.047]	[45]	[0.044]	
Response animal production flood	171	0.502	206	0.580	0.379
	[30]	[0.068]	[34]	[0.057]	
Response animal production drought	211	0.671	248	0.617	0.528
	[32]	[0.059]	[42]	[0.063]	
Response animal production hail	116	0.301	123	0.295	0.952
	[23]	[0.080]	[28]	[0.075]	
Response animal production frost	95	0.403	142	0.366	0.724
	[22]	[0.087]	[29]	[0.060]	
Response fish farming	919	0.073	885	0.185	0.002***
	[39]	[0.018]	[52]	[0.030]	
Response fish farming cyclone	142	0.194	191	0.340	0.084*
	[20]	[0.065]	[35]	[0.054]	
Response fish farming flood	122	0.228	135	0.350	0.232
	[19]	[0.083]	[28]	[0.060]	
Response fish farming drought	132	0.261	154	0.372	0.333
	[16]	[0.078]	[30]	[0.085]	
Response fish farming hail	85	0.132	89	0.193	0.482
	[15]	[0.061]	[20]	[0.061]	
Response fish farming frost	69	0.076	109	0.127	0.332
	[14]	[0.037]	[22]	[0.038]	
Response diversified livelihoods	783	0.397	848	0.348	0.364
	[39]	[0.041]	[52]	[0.035]	
Response diversified livelihoods cyclone	259	0.580	296	0.465	0.285
	[36]	[0.077]	[41]	[0.076]	
Response diversified livelihoods flood	179	0.507	189	0.435	0.505
	[33]	[0.081]	[37]	[0.072]	
Response diversified livelihoods drought	268	0.598	250	0.542	0.600
	[34]	[0.070]	[44]	[0.080]	
Response diversified livelihoods hail	115	0.337	131	0.304	0.775
	[29]	[0.070]	[26]	[0.092]	
Response diversified livelihoods frost	81	0.335	139	0.237	0.441
	[20]	[0.091]	[26]	[0.089]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 98. Top 3 strategies used to reduce sensitivity to climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Improved animal production: Top 1	261	0.751	319	0.835	0.243
	[38]	[0.054]	[48]	[0.047]	
Improved animal production: Top 2	261	0.238	319	0.143	0.130
	[38]	[0.049]	[48]	[0.038]	
Improved animal production: Top 3	261	0.011	319	0.021	0.493
	[38]	[0.010]	[48]	[0.011]	
Fish farming: Top 1	50	0.365	129	0.281	0.441
	[19]	[0.081]	[38]	[0.074]	
Fish farming: Top 2	50	0.473	129	0.574	0.214
	[19]	[0.056]	[38]	[0.060]	
Fish farming: Top 3	50	0.162	129	0.145	0.807
	[19]	[0.055]	[38]	[0.045]	
Diversified livelihoods: Top 1	295	0.760	294	0.629	0.089*
	[35]	[0.045]	[41]	[0.062]	
Diversified livelihoods: Top 2	295	0.228	294	0.338	0.141
	[35]	[0.045]	[41]	[0.059]	
Diversified livelihoods: Top 3	295	0.012	294	0.034	0.190
	[35]	[0.007]	[41]	[0.015]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 99. Main barriers for not using strategies to reduce sensitivity to climate-related hazards, for livestock (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Improved animal production: lack of money	526	0.422	494	0.523	0.144
	[39]	[0.043]	[47]	[0.053]	
Improved animal production: lack of knowledge/skills	526	0.248	494	0.189	0.304
	[39]	[0.034]	[47]	[0.046]	
Improved animal production: lack of technology/tools	526	0.077	494	0.046	0.273
	[39]	[0.024]	[47]	[0.014]	
Improved animal production: lack of interest/not useful	526	0.097	494	0.077	0.526
	[39]	[0.024]	[47]	[0.020]	
Improved animal production: others	526	0.157	494	0.165	0.858
	[39]	[0.033]	[47]	[0.034]	
Fish farming: lack of money	669	0.065	687	0.103	0.114
	[39]	[0.013]	[50]	[0.020]	
Fish farming: lack of knowledge/skills	669	0.261	687	0.322	0.314
	[39]	[0.040]	[50]	[0.046]	
Fish farming: lack of land access	669	0.131	687	0.112	0.696
	[39]	[0.036]	[50]	[0.030]	
Fish farming: lack of technology/tools	669	0.121	687	0.200	0.193
	[39]	[0.044]	[50]	[0.042]	
Fish farming: lack of interest/not useful	669	0.229	687	0.124	0.019**
	[39]	[0.038]	[50]	[0.022]	
Fish farming: others	669	0.193	687	0.138	0.131
	[39]	[0.028]	[50]	[0.024]	
Diversified livelihoods: lack of money	471	0.049	527	0.119	0.041**
	[39]	[0.018]	[51]	[0.029]	
Diversified livelihoods: lack of knowledge/skills	471	0.200	527	0.264	0.184
	[39]	[0.036]	[51]	[0.031]	
Diversified livelihoods: lack of technology/tools	471	0.038	527	0.054	0.535
	[39]	[0.017]	[51]	[0.020]	
Diversified livelihoods: lack of interest/not useful	471	0.159	527	0.156	0.956
	[39]	[0.037]	[51]	[0.040]	
Diversified livelihoods: lack of time	471	0.444	527	0.349	0.194
	[39]	[0.065]	[51]	[0.034]	
Diversified livelihoods: others	471	0.109	527	0.058	0.094*
	[39]	[0.027]	[51]	[0.014]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 100.Strategies used to reduce sensitivity to specific climate-related hazards, for forest and tree product (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reduce forest degradation	925	0.242	893	0.526	0.000***
	[39]	[0.049]	[52]	[0.060]	
Reduce forest degradation: cyclone	213	0.569	390	0.698	0.115
	[29]	[0.070]	[46]	[0.041]	
Reduce forest degradation: flood	163	0.501	281	0.653	0.157
	[25]	[0.084]	[42]	[0.066]	
Reduce forest degradation: drought	213	0.716	354	0.801	0.320
	[31]	[0.072]	[46]	[0.047]	
Reduce forest degradation: hail	93	0.186	155	0.325	0.305
	[22]	[0.057]	[27]	[0.123]	
Reduce forest degradation: frost	85	0.263	165	0.342	0.558
	[16]	[0.081]	[29]	[0.108]	
Diversify livelihoods	926	0.202	893	0.301	0.075*
	[39]	[0.041]	[52]	[0.037]	
Diversify livelihoods: cyclone	202	0.414	284	0.438	0.850
	[28]	[0.102]	[39]	[0.076]	
Diversify livelihoods: flood	129	0.311	185	0.384	0.578
	[24]	[0.100]	[30]	[0.088]	
Diversify livelihoods: drought	223	0.508	248	0.502	0.963
	[28]	[0.097]	[39]	[0.079]	
Diversify livelihoods: hail	87	0.333	131	0.173	0.265
	[22]	[0.107]	[25]	[0.095]	
Diversify livelihoods: frost	75	0.371	149	0.180	0.188
	[15]	[0.124]	[26]	[0.076]	
Improve market products	926	0.051	894	0.135	0.001***
	[39]	[0.014]	[52]	[0.022]	
Improve market products: cyclone	134	0.202	191	0.288	0.340
	[20]	[0.073]	[33]	[0.054]	
Improve market products: flood	108	0.133	138	0.273	0.084*
	[20]	[0.052]	[32]	[0.061]	
Improve market products: drought	138	0.220	166	0.325	0.332
	[20]	[0.073]	[33]	[0.081]	
Improve market products: hail	71	0.062	89	0.148	0.154
	[17]	[0.029]	[21]	[0.052]	
Improve market products: frost	63	0.035	112	0.209	0.001***
	[11]	[0.024]	[25]	[0.043]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 101. Top three strategies used to reduce sensitivity to climate-related hazards, for forest & tree product (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reducing forest degradation: Top 1	236	0.734	475	0.760	0.731
	[32]	[0.067]	[48]	[0.036]	
Reducing forest degradation: Top 2	236	0.242	475	0.210	0.659
	[32]	[0.066]	[48]	[0.034]	
Reducing forest degradation: Top 3	236	0.024	475	0.031	0.702
	[32]	[0.012]	[48]	[0.012]	
Diversification of livelihoods: Top 1	231	0.808	289	0.601	0.002***
	[30]	[0.049]	[40]	[0.044]	
Diversification of livelihoods: Top 2	231	0.156	289	0.331	0.004***
	[30]	[0.041]	[40]	[0.043]	
Diversification of livelihoods: Top 3	231	0.037	289	0.067	0.233
	[30]	[0.015]	[40]	[0.021]	
Improving market products: Top 1	70	0.591	120	0.373	0.059*
	[22]	[0.099]	[36]	[0.058]	
Improving market products: Top 2	70	0.353	120	0.453	0.358
	[22]	[0.091]	[36]	[0.060]	
Improving market products: Top 3	70	0.055	120	0.174	0.047**
	[22]	[0.032]	[36]	[0.049]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 102. Main barriers for not using strategies to reduce sensitivity to climate-related hazards (for forest and tree product) (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Reducing forest degradation: lack of money	372	0.072	310	0.076	0.890
	[32]	[0.023]	[42]	[0.018]	
Reducing forest degradation: lack of knowledge/skills	372	0.381	310	0.484	0.190
	[32]	[0.048]	[42]	[0.062]	
Reducing forest degradation: lack of interest/not useful	372	0.206	310	0.180	0.706
	[32]	[0.049]	[42]	[0.048]	
Reducing forest degradation: lack of time	372	0.068	310	0.080	0.672
	[32]	[0.015]	[42]	[0.025]	
Reducing forest degradation: others	372	0.273	310	0.180	0.122
	[32]	[0.044]	[42]	[0.040]	
Diversification of livelihoods: lack of money	383	0.054	504	0.137	0.028**
	[32]	[0.016]	[48]	[0.033]	
Diversification of livelihoods: lack of knowledge/skills	383	0.342	504	0.351	0.878
	[32]	[0.041]	[48]	[0.043]	
Diversification of livelihoods: lack of technology/tools	383	0.066	504	0.047	0.637
	[32]	[0.034]	[48]	[0.018]	
Diversification of livelihoods: lack of interest/not useful	383	0.180	504	0.127	0.244
	[32]	[0.039]	[48]	[0.024]	
Diversification of livelihoods: lack of time	383	0.290	504	0.287	0.961
	[32]	[0.046]	[48]	[0.036]	
Diversification of livelihoods: others	383	0.068	504	0.050	0.482
	[32]	[0.023]	[48]	[0.012]	
Improving market products: lack of money	559	0.058	675	0.136	0.008***
	[32]	[0.018]	[50]	[0.023]	
Improving market products: lack of knowledge/skills	559	0.498	675	0.517	0.812
	[32]	[0.060]	[50]	[0.050]	
Improving market products: lack of technology/tools	559	0.206	675	0.129	0.270
	[32]	[0.061]	[50]	[0.034]	
Improving market products: lack of interest/not useful	559	0.132	675	0.100	0.462
	[32]	[0.031]	[50]	[0.030]	
Improving market products: others	559	0.105	675	0.118	0.657
	[32]	[0.021]	[50]	[0.021]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 103. Number of days in the last 30 days the household members eat these food items

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cereals	926	29.738	894	29.564	0.427
	[39]	[0.114]	[52]	[0.187]	
Legumes	926	12.129	894	10.064	0.275
	[39]	[1.516]	[52]	[1.130]	
Milk	926	1.260	894	1.021	0.582
	[39]	[0.299]	[52]	[0.318]	
Meat	926	3.634	879	3.662	0.969
	[39]	[0.503]	[52]	[0.527]	
Flesh	925	2.795	894	3.064	0.540
	[39]	[0.363]	[52]	[0.250]	
Organ	925	0.280	894	0.328	0.709
	[39]	[0.084]	[52]	[0.096]	
Fish	925	3.382	894	4.174	0.249
	[39]	[0.424]	[52]	[0.540]	
Eggs	925	1.072	894	1.530	0.144
	[39]	[0.252]	[52]	[0.185]	
Vegetables	926	14.773	875	10.884	0.126
	[39]	[1.776]	[52]	[1.800]	
Orange vegetables	926	4.637	894	2.973	0.043**
	[39]	[0.599]	[52]	[0.551]	
Green leafy vegetables	926	20.335	894	19.888	0.698
	[39]	[0.742]	[52]	[0.885]	
Fruits	925	6.668	874	5.243	0.468
	[39]	[1.614]	[52]	[1.125]	
Orange fruits	926	7.085	894	4.775	0.248
	[39]	[1.597]	[52]	[1.199]	
Oil fat	926	22.323	894	19.947	0.114
	[39]	[1.039]	[52]	[1.079]	
Sugar	926	20.342	894	18.505	0.326
	[39]	[1.107]	[52]	[1.505]	
Condiments	926	29.517	894	29.614	0.627
	[39]	[0.166]	[52]	[0.115]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 104. Monetary value of food items for domestic consumption, with and without purchasing, in the last 30 days (in ariary) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Cereals cash	926	50694.457	894	40731.633	0.156
	[39]	[6122.406]	[52]	[3399.320]	
Cereal credit	926	1935.452	894	3462.157	0.330
	[39]	[1044.832]	[52]	[1168.612]	
Cereals without purchasing	926	51332.730	894	51395.415	0.994
	[39]	[5980.209]	[52]	[5651.582]	
Tubers cash	926	3386.802	893	4626.277	0.434
	[39]	[694.558]	[52]	[1424.128]	
Tubers credit	924	70.644	893	247.880	0.228
	[39]	[45.118]	[52]	[139.547]	
Tubers without purchasing	926	47435.002	893	35242.200	0.342
	[39]	[12229.428]	[52]	[3939.922]	
Pulses cash	915	8137.988	894	5985.879	0.136
	[39]	[1306.330]	[52]	[604.408]	
Pulses credit	915	78.607	894	126.562	0.472
	[39]	[44.638]	[52]	[49.581]	
Pulses without purchasing	915	11669.018	894	7001.556	0.060*
	[39]	[2210.959]	[52]	[1095.407]	
Fruits cash	926	4232.129	894	1884.230	0.212
	[39]	[1844.285]	[52]	[380.163]	
Fruits credit	926	29.983	893	49.449	0.582
	[39]	[23.389]	[52]	[26.549]	
Fruits without purchasing	926	9745.625	893	10298.437	0.772
	[39]	[1325.997]	[52]	[1373.182]	
Fish/meat cash	922	20835.939	894	16439.402	0.264
	[39]	[2792.982]	[52]	[2765.750]	
Fish/meat cedit	922	78.972	894	498.649	0.037**
	[39]	[56.678]	[52]	[190.624]	
Fish/meat without purchasing	922	11214.906	894	19125.340	0.011**
	[39]	[1831.026]	[52]	[2465.993]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 105. Monetary value of food items for domestic consumption, with and without purchasing, in the last 30 days (in ariary) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Oil cash	921	5235.162	894	5341.575	0.880
	[39]	[458.579]	[52]	[541.078]	
Oil credit	921	6.995	894	53.533	0.128
	[39]	[5.489]	[52]	[29.886]	
Oil without purchasing	921	181.312	894	289.566	0.506
	[39]	[121.424]	[52]	[109.064]	
Milk cash	865	551.921	894	481.706	0.768
	[38]	[154.213]	[52]	[182.402]	
Milk credit	865	3.768	894	4.660	0.871
	[38]	[2.726]	[52]	[4.768]	
Milk without purchasing	865	625.645	894	506.287	0.830
	[38]	[526.778]	[52]	[187.864]	
Sugar cash	926	6371.343	894	6709.524	0.708
	[39]	[569.476]	[52]	[703.663]	
Sugar credit	926	40.915	894	93.975	0.392
	[39]	[30.142]	[52]	[54.118]	
Sugar without purchasing	925	158.896	894	673.954	0.016**
	[39]	[87.134]	[52]	[192.663]	
Tea cash	908	7858.104	894	6320.098	0.047**
	[39]	[654.161]	[52]	[406.035]	
Tea credit	908	77.987	894	133.942	0.537
	[39]	[51.319]	[52]	[74.761]	
Tea without purchasing	908	599.105	894	1100.868	0.161
	[39]	[261.772]	[52]	[242.526]	
Other cash	926	1468.183	892	1665.134	0.674
	[39]	[333.575]	[52]	[330.446]	
Other credit	926	0.070	892	51.636	0.050**
	[39]	[0.072]	[52]	[26.037]	
Other without purchasing	926	40.238	892	499.094	0.092*
	[39]	[17.464]	[52]	[269.603]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 106. Non-food household expenditure in the last 30 days (in ariary)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Expenditure Alcohol	925	4475.434	892	4428.330	0.955
	[39]	[760.531]	[52]	[336.423]	
Expenditure Soap	925	4484.484	894	5433.732	0.088*
	[39]	[398.273]	[52]	[385.085]	
Expenditure Transport	925	7820.239	893	7814.707	0.999
	[39]	[2736.944]	[52]	[3141.923]	
Expenditure Fuel	925	3003.749	894	3002.331	0.998
	[39]	[568.334]	[52]	[372.554]	
Expenditure Water	925	239.943	894	66.543	0.397
	[39]	[201.917]	[52]	[35.730]	
Expenditure Electricity	920	587.186	894	879.506	0.347
	[39]	[270.629]	[52]	[153.859]	
Expenditure Communication	925	2958.107	894	2576.705	0.661
	[39]	[675.628]	[52]	[552.779]	
Expenditure Rent	925	817.168	893	948.783	0.796
	[39]	[338.864]	[52]	[382.892]	
Expenditure Medical Expenses	922	52116.115	892	52214.010	0.992
	[39]	[7429.366]	[52]	[6336.801]	
Expenditure Clothing	925	36568.989	893	43362.244	0.191
	[39]	[4401.908]	[52]	[2741.050]	
Expenditure Education	924	37596.170	892	44477.579	0.376
	[39]	[5739.690]	[52]	[5259.446]	
Expenditure Debts Repayment	925	56890.547	891	45221.609	0.288
	[39]	[9908.019]	[52]	[4740.465]	
Expenditure Social Events	923	69673.742	894	51217.376	0.091*
	[39]	[8902.991]	[52]	[6225.616]	
Expenditure Agricultural Inputs	925	20583.407	894	35171.551	0.012**
	[39]	[2864.437]	[52]	[4978.969]	
Expenditure Savings	921	22648.929	887	16108.354	0.382
	[39]	[5901.429]	[52]	[4618.708]	
Expenditure House Repairs	923	48090.766	891	48541.652	0.984
	[39]	[13412.265]	[52]	[18033.440]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 107. Livelihood-based coping strategies for food shortage in the last 30 days (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Spent savings or borrowed money: No, because no shortage of food	926	0.471	894	0.470	0.975
	[39]	[0.030]	[52]	[0.028]	
Spent savings or borrowed money: No, because assets already sold	926	0.147	894	0.105	0.298
	[39]	[0.031]	[52]	[0.026]	
Spent savings or borrowed money: Yes	926	0.381	894	0.425	0.372
	[39]	[0.035]	[52]	[0.034]	
Reduced meals quantities: No, because no shortage of food	926	0.323	894	0.274	0.357
	[39]	[0.037]	[52]	[0.039]	
Reduced meals quantities: No, because assets already sold	926	0.148	894	0.058	0.011**
	[39]	[0.029]	[52]	[0.019]	
Reduced meals quantities: Yes	926	0.529	894	0.669	0.035**
	[39]	[0.049]	[52]	[0.044]	
Harvested wild food: No, because no shortage of food	926	0.777	894	0.692	0.153
	[39]	[0.045]	[52]	[0.038]	
Harvested wild food: No, because assets already sold	926	0.109	894	0.153	0.384
	[39]	[0.030]	[52]	[0.041]	
Harvested wild food: Yes	926	0.114	894	0.155	0.257
	[39]	[0.023]	[52]	[0.027]	
Changed seed varieties: No, because no shortage of food	926	0.772	894	0.730	0.473
	[39]	[0.044]	[52]	[0.040]	
Changed seed varieties: No, because assets already sold	926	0.127	894	0.126	0.985
	[39]	[0.036]	[52]	[0.036]	
Changed seed varieties: Yes	926	0.100	894	0.144	0.192
	[39]	[0.019]	[52]	[0.027]	
Withdrew children from school: No, because no shortage of food	926	0.797	894	0.767	0.604
	[39]	[0.042]	[52]	[0.040]	
Withdrew children from school: No, because assets already sold	926	0.122	894	0.151	0.594
	[39]	[0.037]	[52]	[0.039]	
Withdrew children from school: Yes	926	0.081	894	0.082	0.954
	[39]	[0.015]	[52]	[0.016]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 108. Livelihood-based coping strategies for food shortage in the last 30 days (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Harvested immature crops: No, because no shortage of food	926	0.564	894	0.532	0.476
	[39]	[0.033]	[52]	[0.029]	
Harvested immature crops: No, because assets already sold	926	0.136	894	0.129	0.867
	[39]	[0.028]	[52]	[0.031]	
Harvested immature crops: Yes	926	0.300	894	0.339	0.388
	[39]	[0.030]	[52]	[0.033]	
Sold productive assets: No, because no shortage of food	926	0.826	894	0.819	0.904
	[39]	[0.042]	[52]	[0.042]	
Sold productive assets: No, because assets already sold	926	0.134	894	0.152	0.763
	[39]	[0.041]	[52]	[0.043]	
Sold productive assets: Yes	926	0.039	894	0.029	0.499
	[39]	[0.013]	[52]	[0.008]	
Sold or abandoned land or building: No, because no shortage of food	926	0.855	894	0.835	0.747
	[39]	[0.042]	[52]	[0.044]	
Sold or abandoned land or building: No, because assets already sold	926	0.131	894	0.147	0.782
	[39]	[0.041]	[52]	[0.043]	
Sold or abandoned land or building: Yes	926	0.015	894	0.018	0.753
	[39]	[0.006]	[52]	[0.008]	
Sold last female animal or last seeds reserves: No, because no shortage of food	926	0.777	893	0.728	0.397
	[39]	[0.042]	[52]	[0.040]	
Sold last female animal or last seeds reserves: No, because assets already sold	926	0.143	893	0.142	0.994
	[39]	[0.038]	[52]	[0.037]	
Sold last female animal or last seeds reserves: Yes	926	0.081	893	0.130	0.123
	[39]	[0.017]	[52]	[0.027]	
Migrated for longer/more people than usual: No, because no shortage of food	926	0.788	894	0.743	0.464
	[39]	[0.047]	[52]	[0.040]	
Migrated for longer/more people than usual: No, because assets already sold	926	0.134	894	0.144	0.859
	[39]	[0.039]	[52]	[0.040]	
Migrated for longer/more people than usual: Yes	926	0.078	894	0.113	0.277
	[39]	[0.017]	[52]	[0.027]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 109. Access to weather forecast (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Information received	926	0.618	894	0.616	0.973
	[39]	[0.032]	[52]	[0.039]	
Receive information from (source 1): Radio	605	0.612	577	0.673	0.304
	[39]	[0.040]	[52]	[0.044]	
Receive information from (source 1): Family or Friends	605	0.356	577	0.286	0.220
	[39]	[0.037]	[52]	[0.044]	
Receive information from (source 1): Others	605	0.032	577	0.041	0.555
	[39]	[0.012]	[52]	[0.010]	
Receive information from (source 2): Radio	128	0.064	153	0.065	0.975
	[31]	[0.029]	[38]	[0.031]	
Receive information from (source 2): Family or Friends	128	0.854	153	0.773	0.244
	[31]	[0.054]	[38]	[0.043]	
Receive information from (source 2): Others	128	0.083	153	0.162	0.162
	[31]	[0.033]	[38]	[0.046]	
Advice on how to use the information	849	0.204	828	0.272	0.140
	[39]	[0.030]	[52]	[0.035]	
Modify the practices after information	905	0.080	869	0.113	0.298
	[39]	[0.020]	[52]	[0.025]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 110. Understanding and knowledge of climate change (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Understanding of Climate Change: Do not understand	926	0.283	894	0.239	0.267
	[39]	[0.026]	[52]	[0.031]	
Understanding of Climate Change: More or less correct	926	0.625	894	0.615	0.788
	[39]	[0.028]	[52]	[0.026]	
Understanding of Climate Change: fully understand	926	0.091	894	0.146	0.051*
	[39]	[0.013]	[52]	[0.024]	
Understanding of the impact of Climate Change: Do not understand	926	0.219	894	0.216	0.935
	[39]	[0.026]	[52]	[0.027]	
Understanding of the impact of Climate Change: More or less correct	926	0.657	894	0.577	0.078*
	[39]	[0.032]	[52]	[0.032]	
Understanding of the impact of Climate Change: fully understand	926	0.124	894	0.207	0.040**
	[39]	[0.021]	[52]	[0.034]	
Understanding that nature can help to adapt to CC: Do not understand	926	0.562	894	0.369	0.007***
	[39]	[0.049]	[52]	[0.051]	
Understanding that nature can help to adapt to CC: More or less correct	926	0.335	894	0.464	0.029**
	[39]	[0.039]	[52]	[0.043]	
Understanding that nature can help to adapt to CC: fully understand	926	0.103	894	0.167	0.089*
	[39]	[0.021]	[52]	[0.031]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 111. Changes in forested areas in the last 5 years (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Quality: Greatly decreased	874	0.090	864	0.152	0.030**
	[39]	[0.014]	[52]	[0.025]	
Quality: Slightly decreased	874	0.079	864	0.225	0.000***
	[39]	[0.023]	[52]	[0.027]	
Quality: About the same	874	0.146	864	0.291	0.000***
	[39]	[0.025]	[52]	[0.030]	
Quality: Slightly increased	874	0.116	864	0.179	0.022**
	[39]	[0.019]	[52]	[0.019]	
Quality: Greatly increased	874	0.568	864	0.153	0.000***
	[39]	[0.044]	[52]	[0.028]	
Quantity: Greatly decreased	879	0.333	876	0.172	0.026**
	[39]	[0.066]	[52]	[0.028]	
Quantity: Slightly decreased	879	0.116	876	0.264	0.000***
	[39]	[0.018]	[52]	[0.028]	
Quantity: About the same	879	0.138	876	0.254	0.005***
	[39]	[0.024]	[52]	[0.032]	
Quantity: Slightly increased	879	0.077	876	0.155	0.011**
	[39]	[0.019]	[52]	[0.023]	
Quantity: Greatly increased	879	0.336	876	0.155	0.002***
	[39]	[0.049]	[52]	[0.029]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 112. Causes of deforestation and level of protection

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Main cause deforestation: Shifting cultivation	777	0.485	762	0.595	0.118
	[39]	[0.051]	[52]	[0.048]	
Main cause deforestation: Cropping	777	0.272	762	0.092	0.003***
	[39]	[0.052]	[52]	[0.030]	
Main cause deforestation: Timber extraction	777	0.083	762	0.060	0.408
	[39]	[0.023]	[52]	[0.015]	
Main cause deforestation: Firewood	777	0.105	762	0.083	0.517
	[39]	[0.028]	[52]	[0.019]	
Main cause deforestation: Natural hazards	777	0.025	762	0.099	0.003***
	[39]	[0.012]	[52]	[0.022]	
Main cause deforestation: Others	777	0.029	762	0.071	0.043**
	[39]	[0.008]	[52]	[0.019]	
Satisfaction level of protection: Not at all satisfied	788	0.408	886	0.136	0.000***
	[39]	[0.035]	[52]	[0.021]	
Satisfaction level of protection: Slightly satisfied	788	0.152	886	0.114	0.225
	[39]	[0.028]	[52]	[0.015]	
Satisfaction level of protection: Moderately satisfied	788	0.167	886	0.224	0.084*
	[39]	[0.018]	[52]	[0.027]	
Satisfaction level of protection: Very satisfied	788	0.237	886	0.390	0.001***
	[39]	[0.031]	[52]	[0.030]	
Satisfaction level of protection: Extremely satisfied	788	0.035	886	0.137	0.000***
	[39]	[0.011]	[52]	[0.024]	
Illegal activities: It is never OK	893	0.683	888	0.834	0.001***
	[39]	[0.031]	[52]	[0.029]	
Illegal activities: It is sometime/under certain circumstance OK	893	0.247	888	0.150	0.014**
	[39]	[0.026]	[52]	[0.028]	
Illegal activities: It is always OK	893	0.070	888	0.016	0.002***
	[39]	[0.016]	[52]	[0.006]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 113. Opinions towards the management of protected areas by the VOI (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Violation of the rules: No	887	0.919	890	0.743	0.000***
	[39]	[0.016]	[52]	[0.040]	
Violation of the rules: Yes, sometimes	887	0.057	890	0.114	0.029**
	[39]	[0.012]	[52]	[0.023]	
Violation of the rules: Yes, always	887	0.025	890	0.143	0.000***
	[39]	[0.006]	[52]	[0.023]	
Protected areas: Relying a lot less	880	0.604	885	0.615	0.799
	[39]	[0.032]	[52]	[0.031]	
Protected areas: Relying a slightly less	880	0.059	885	0.101	0.159
	[39]	[0.014]	[52]	[0.026]	
Protected areas: About the same	880	0.073	885	0.056	0.471
	[39]	[0.019]	[52]	[0.015]	
Protected areas: Relying a slightly more	880	0.070	885	0.066	0.736
	[39]	[0.009]	[52]	[0.010]	
Protected areas: Relying a lot more	880	0.193	885	0.162	0.392
	[39]	[0.022]	[52]	[0.029]	
areas that should be protected and restored	923	0.336	890	0.255	0.125
	[39]	[0.039]	[52]	[0.035]	
VOI perception	432	3.704	878	4.262	0.000***
	[36]	[0.107]	[52]	[0.068]	
Voice heard VOI man: No	19	0.053	762	0.077	0.244
	[3]	[0.013]	[52]	[0.017]	
Voice heard VOI man: Sometimes	19	0.179	762	0.155	0.476
	[3]	[0.031]	[52]	[0.022]	
Voice heard VOI man: yes	19	0.768	762	0.768	0.997
	[3]	[0.039]	[52]	[0.029]	
Voice heard VOI woman: No	16	0.125	478	0.103	0.432
	[1]	[0.000]	[47]	[0.027]	
Voice heard VOI woman: Sometimes	16	0.125	478	0.175	0.101
	[1]	[0.000]	[47]	[0.030]	
Voice heard VOI woman: yes	16	0.750	478	0.722	0.548
	[1]	[0.000]	[47]	[0.046]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 114. Markets (where products are sold and the main barriers to sell them)

Variables	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Sell products: Market outside the village (%)	922	0.111	878	0.188	0.129
	[39]	[0.031]	[52]	[0.040]	
Sell products: Sold little things in the village (%)	922	0.063	878	0.100	0.216
	[39]	[0.017]	[52]	[0.025]	
Sell products: Commune's market (%)	922	0.550	878	0.471	0.366
	[39]	[0.052]	[52]	[0.070]	
Sell products: Collector (%)	922	0.073	878	0.089	0.711
	[39]	[0.023]	[52]	[0.034]	
Sell products: Do not sell (%)	922	0.181	878	0.097	0.181
	[39]	[0.035]	[52]	[0.052]	
Sell products: Others (%)	922	0.022	878	0.055	0.148
	[39]	[0.008]	[52]	[0.022]	
Market distance (in min)	809	134.444	829	112.633	0.356
	[39]	[20.879]	[52]	[11.153]	
Barrier: Low prices (%)	799	0.167	836	0.129	0.215
	[39]	[0.021]	[52]	[0.021]	
Barrier: Road inexistent (%)	799	0.381	836	0.476	0.140
	[39]	[0.047]	[52]	[0.044]	
Barrier: No barriers (%)	799	0.178	836	0.230	0.259
	[39]	[0.036]	[52]	[0.029]	
Barrier: Bad/Few or No production (%)	799	0.140	836	0.052	0.001***
	[39]	[0.024]	[52]	[0.012]	
Barrier: Other (%)	799	0.135	836	0.113	0.443
	[39]	[0.019]	[52]	[0.020]	
Product value added (%)	926	0.102	894	0.104	0.948
	[39]	[0.019]	[52]	[0.026]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 115. Information about markets and organization membership (in %)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Information about market and prices	926	0.237	893	0.253	0.779
	[39]	[0.035]	[52]	[0.047]	
Source of information: Radio	235	0.228	241	0.319	0.271
	[35]	[0.042]	[37]	[0.071]	
Source of information: Family or Friends	235	0.687	241	0.591	0.353
	[35]	[0.048]	[37]	[0.092]	
Source of information: Others	235	0.085	241	0.090	0.916
	[35]	[0.026]	[37]	[0.040]	
Advice was used	269	0.282	324	0.329	0.561
	[35]	[0.041]	[42]	[0.069]	
Practices were modified	166	0.274	187	0.301	0.751
	[30]	[0.052]	[32]	[0.068]	
Type of organization: Farmer's association	926	0.073	894	0.101	0.513
	[39]	[0.022]	[52]	[0.037]	
Type of organization: Women's group	926	0.223	894	0.314	0.179
	[39]	[0.042]	[52]	[0.053]	
Type of organization: Youth group	926	0.125	894	0.142	0.696
	[39]	[0.028]	[52]	[0.034]	
Type of organization: Others	926	0.121	894	0.115	0.890
	[39]	[0.030]	[52]	[0.027]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 116. Assets ownership (in %) (part 1)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Mobile phone	926	0.366	894	0.304	0.266
	[39]	[0.045]	[52]	[0.034]	
Radio	926	0.483	894	0.516	0.479
	[39]	[0.029]	[52]	[0.036]	
Television	926	0.049	894	0.038	0.654
	[39]	[0.021]	[52]	[0.010]	
Internet access	926	0.012	894	0.008	0.558
	[39]	[0.007]	[52]	[0.003]	
Mobile banking	926	0.037	894	0.056	0.333
	[39]	[0.017]	[52]	[0.011]	
VHS reader	926	0.057	894	0.108	0.050*
	[39]	[0.012]	[52]	[0.023]	
Amplifier	926	0.085	894	0.099	0.565
	[39]	[0.016]	[52]	[0.019]	
Bed	926	0.723	894	0.751	0.600
	[39]	[0.039]	[52]	[0.037]	
Sewing Machine	926	0.068	894	0.078	0.601
	[39]	[0.009]	[52]	[0.015]	
Generator (group)	926	0.014	894	0.019	0.444
	[39]	[0.004]	[52]	[0.005]	
Petrol Lamp	926	0.521	894	0.578	0.411
	[39]	[0.052]	[52]	[0.047]	
Solar panel	926	0.271	894	0.294	0.708
	[39]	[0.043]	[52]	[0.041]	
Improved cooking stoves	926	0.040	894	0.041	0.973
	[39]	[0.017]	[52]	[0.009]	
Cleaver (big knife)	926	0.912	894	0.942	0.154
	[39]	[0.017]	[52]	[0.013]	
Machete	926	0.878	894	0.923	0.043**
	[39]	[0.018]	[52]	[0.012]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 117. Assets ownership (in %) (part 2)

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Plough	926	0.091	894	0.138	0.298
	[39]	[0.027]	[52]	[0.037]	
Chainsaw	926	0.017	894	0.015	0.880
	[39]	[0.010]	[52]	[0.007]	
Storage room/facilities	926	0.152	894	0.239	0.054*
	[39]	[0.034]	[52]	[0.030]	
Motor pump	926	0.005	894	0.002	0.299
	[39]	[0.003]	[52]	[0.001]	
Sprayer	926	0.009	894	0.044	0.014**
	[39]	[0.003]	[52]	[0.014]	
Rice husker	926	0.000	894	0.004	0.094*
	[39]	[0.000]	[52]	[0.002]	
Kibota	926	0.000	894	0.005	0.029**
	[39]	[0.000]	[52]	[0.002]	
Herse	926	0.026	894	0.060	0.079*
	[39]	[0.011]	[52]	[0.016]	
Watering canister	926	0.036	894	0.172	0.000***
	[39]	[0.009]	[52]	[0.027]	
Tractor or rototiller	926	0.000	894	0.008	0.013**
	[39]	[0.000]	[52]	[0.003]	
Bicycle	926	0.041	894	0.054	0.652
	[39]	[0.024]	[52]	[0.015]	
Motorcycle/Moped	926	0.015	894	0.007	0.458
	[39]	[0.010]	[52]	[0.003]	
Oxcart	926	0.003	894	0.008	0.326
	[39]	[0.002]	[52]	[0.004]	
Lorry/ 4*4	926	0.003	894	0.005	0.635
	[39]	[0.002]	[52]	[0.004]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

Appendix table 118. Land preparation, harvest and processing

Variable	N/[Clusters]	(1) Control Mean/SE	N/[Clusters]	(2) Phase 1 Mean/SE	t-test p-value (1)-(2)
Land preparation people/day (rice)	880	23.420	875	16.772	0.102
	[39]	[3.212]	[52]	[2.471]	
Land preparation days (rice)	879	22.404	875	21.490	0.807
	[39]	[2.415]	[52]	[2.875]	
Land preparation people/day (other crops)	906	12.163	877	6.947	0.013**
	[39]	[1.891]	[52]	[0.845]	
Land preparation days (other crops)	905	20.302	877	14.320	0.181
	[39]	[3.760]	[52]	[2.416]	
Land harvesting and processing people/days (rice)	879	13.376	875	14.792	0.630
	[39]	[1.652]	[52]	[2.435]	
Land harvesting and processing days (rice)	878	6.445	875	6.853	0.795
	[39]	[1.141]	[52]	[1.085]	
land harvesting and processing people/days (other crops)	904	3.718	871	3.677	0.948
	[39]	[0.486]	[52]	[0.398]	
Land harvesting and processing days (other crops)	904	101.124	869	54.950	0.047**
	[39]	[18.632]	[52]	[13.550]	

The value displayed for t-tests are p-values. Standard errors are clustered at Fokontany level. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. Estimations account for sampling weights.

b. Appendix 2: Household survey questionnaire

GCF Madagascar – Household Survey

[Before starting the interview, please give a short introduction to explain who we are, what are the objectives of the interview, how the confidentiality of answers is guaranteed and finally asks for informed consent].

Good morning/afternoon, I/we are [NAMES] from **Conservation International Madagascar**. We are working for a project called "**Sustainable Landscapes in Eastern Madagascar**" supported by Green Climate Fund. As part of this project, one objective is to help strengthen the role of sustainable forest and agriculture management for the benefit of communities and the environment in some villages around CAZ and COFAV protected areas. The project will implement several activities in some villages in different phases to improve the resilience of livelihoods of smallholders and sustainably manage forests and agriculture, especially during time of stress due to extreme weather events (e.g. floods, droughts, strong winds, hail, frost related to climate change). The selected villages will not receive the interventions of the project at the same time because of logistic and methodological reasons (it might take from 1 to 3 years or more).

We have randomly selected [NUMBER] villages and [NUMBER] households to collect information on land uses and livelihoods strategies. Your household is one of the selected households. We have visited the head of the Fokontany and Tangalamena (………………………………………………………………………… : ……………………………………………………………………….) and have his/her permission to carry out this interview. This information will be useful to develop a baseline regarding climate change vulnerability and food security and monitor changes over time. All personal information such as your name will be written in this form to facilitate conducting the interview, in case we need to come back for clarifications, and for follow up (which will be done approximately 2.5 years and 5 years from now). This information will be kept completely confidential which means your name will not be connected with your answers and will not be shared with anyone other than a few members of our team.

A summary of the main results of this research will be provided to all the communities participating in the survey, in both a written format (published report), as well as through oral presentations in meetings with each community.

This interview is voluntary, you may stop at any point and ask questions or request an explanation. Your village chief has our contact information for any clarification that you may need.

Do you agree to participate in this survey and can we start? (oral consent) |______|

Would be OK to take a picture with you (for us to follow up in few years)? |______|

We thank you for participating in the survey.

Module A: household characteristics

	Controls	NAME ENUMERATOR NAME CHIEF ENUMERATOR NAME DATA MANAGER DATE CHECK CHIEF ENUMERATOR DATE CHECK DATA MANAGER DD MM YY
1.	**Site**	NAMES CAZ/COFAV Commune Fokontany Village ASSOCIATON TYPE (woman, PAP, VOI) VOI NAME use –7=don't want to answer; --8=not applied, -9=don't know MODULAR HH ID CODE PROV COMMUNE FOKONTANY VILLAGE ASSOC. TYPE VOI HH NUMBER
2.	**Date/Time**	: // : DD MM YY start time interview end time interview
3.	**Household location** (GPS coordinates)	° ' . " S // ° ' " E // Degree Minutes Seconds Degree Minutes Seconds
4.	**Household location** (GPS point mark)	GPS POINT NAME
5.	**Household distances from Fokontani cenetre**	FOKONTANY CENTER MINUTES
6.	**Household distances from closest forest**	CLOSEST FOREST MINUTES
7.	**Respondent's name/ Nick name:**	Men Women

8.	What is your Ethnicity?	☐ Antakarana………….1 Antandroy…………..2 Antanosy………………3 Antefasy………………4 Antembahoaka…….5 Antemoro……………6 Antesaka………………7 Bara……………………..8 Betsileo………………..9 Betsimisaraka……………….10 Bezanozano…………………..11 Mahafaly……………………….12 Merina…………………………..13 Sakalava………………………..14 Sihanaka……………………….15 Tanala…………………………….16 Tsimihety……………………….17 Vezo……………………………….18 other (specify)……………….19
9.	When were you born? (year mandatory, reported estimation possible)	☐☐☐☐ YYYY
10.	Who is the head of the Household?	☐ Male headed, with a wife or wives…………………………………………1 Male headed, divorced, single or widowed……………………………………2 Female headed, divorced, single or widowed……………………………………………….3 Female headed, husband away, wife makes most household/agricultural decision ……………4
11.	What is the highest education level <u>completed</u> by the HH respondent?	☐ Has never gone to School………………………1 Elementary school ……………………………..2 Lower/Junior High School………………………3 Higher/Senior High School ……………………..4 technical training …………………………………..5
12.	Who are the members of your household?	___ Total number of individuals in the household
		___ Total number of elderly individuals (>60 years old)
		___ number of adults (18-60 years old)
		___ number of youth (12-18 years old)
		___ number of children in school age (6-12 years old)
		___ number of children from 0-5 years old
13.	How many children in school age that are attending school?	___ number of children in school age currently attending school

14.	**What is the highest education level <u>completed</u> by the head of the household?** (Do not ask this question if the respondent is the head of the household)	☐	Has never gone to School...........................1 Elementary school ....2 Lower/Junior High School...........................3 Higher/Senior High School ....4 technical training 5	
15.	**Can you read?**	☐	No .... 1 Yes, Malagasy .... 2 Yes, Malagasy and French .... 3 Others, please cite: 4	
16.	**Does this house belong to you/partner?**	☐	own .... 1 rented .... 2 borrowed/family... ....3 Other, please describe:..4	
17.	**How long have you been living in this village?**	YEARS	☐☐	
18.	**Where were you before and why did you move to this village?**	☐ FROM	Same VILLAGE .... 0 Village in same FOKONTANY 1 Village in same COMMUNE .....2 Village in same PROVINCE... .....3 Village in OTHER PROVINCE 4	☐ WHY Work opportunity.................... 1 Lack of land .... 2 Family (wife/husband)............ 3 Social conflicts or violence ...... 4 Climate/Natural hazards ....5 Other 6

19.	House Characteristics (observation and doublecheck with question)		CODE: 1	CODE: 2.	CODE 3
		1. ROOF ☐	Local biotic materials No/little value added: e.g. thatch	Local materials Medium value added: e.g. local wood boards or vakona leaves,	Nonlocal material High value added: e.g. metal, clay tiles
		2. WALL ☐	Local biotic materials No/little value added: e.g. leaves, poles, bamboo	Local materials Medium value added: e.g. local wood boards, rapaka (ravinala trunk), rotsopeta (mud)	Non-local material High value added: e.g. masonry, bricks, parpaing, vato
		3.FLOOR ☐	No/little value added: e.g. soil	Local materials Medium value added: e.g. local wood boards	Non-local material High value added: e.g. ceramic tiles, colored (cemented) floor

		4. Number total of rooms (including external kitchen, bathrooms, toilet) ☐	
20.	Household Facilities	1. ELECTRICITY ☐	1 = no electricity used; 2 = unpaid connection to grid or through village system; 3 =paid connection to electrical grid; 4 = use of own generator or solar panel
		2. WATER ☐	1 = stream, river, pond; 2 = common faucet or well, or neighbor's faucet or well, or common rain-fed reservoir; 3 = own well or own rain-fed reservoir; 4 = piped water from groundwater beneath house; 5 = piped water from municipal system or water company;
		3. TOILET ☐	0= if you don't have, why?____________________________ 1 = stream, river, pond, open air, neighbor's faucet or well, or common rain-fed reservoir 2 = shared latrine with pit or floating over water (not flushed with water) 3 = own latrine with pit or floating over water (not flushed with water 4 = own latrine, with water (flushed by pouring water) 5 = own flush toilet , with piped water but not septic system) 6 = own flush toilet, with piped water and with septic system
		4.COOKING ☐ ☐ ☐	1 = fuelwood; 2 = charcoal; 3 = other vegetative biomass (shrubs, leaves, agricultural residues); 4 = dung; 5 = biogas; 6 = oil, kerosene; petrol 7 = liquefied petroleum gas (LPG); 8= electricity; 9 = solar 10 others ….

Module B:
household livelihoods

[In this part of the interview, we want to understand better your livelihood activities]

No.	Question	Response	
21.	What are the main sources of livelihood/ income of your household during the wet season?	1. PRIMARY ☐ 2. SECONDARY ☐ 3. TERTIARY ☐ OTHER OTHER OTHER	crop farming ....1 livestock farming ....2 fisheries...3 harvesting wild forest products ....4 harvesting timber ....5 public work ....6 construction......................................7 other (specify) 8
22.	What are the main sources of livelihood/ income of your household during the dry season?	1. PRIMARY ☐ 2. SECONDARY ☐ 3. TERTIARY ☐ OTHER OTHER OTHER	

23.	What are the three most important crop, animal and forest/tree products for your household's livelihood? [repeat that this information is confidential and only used to understand needs of households] [write down the full list of products and then identify the top 3 products for each category]	CROP		LIVESTOCK/ DOMESTIC ANMALS		FOREST & TREE PRODUCT/WILD ANIMALS	
		1. TOP1 ☐		☐		☐	
		2. TOP2 ☐		☐		☐	
		3. TOP3 ☐		☐		☐	
		4. other ☐		☐		☐	
		5 other ☐		☐		☐	
		6 other ☐		☐		☐	

		7 other ☐ 8 other ☐ 9 other ☐ 10 other ☐	1=Cassava, 2=Rice, 3=Maize, 4=Bananas, 5= Beans, 6=Sugarcane, 7=Sweet potatoes, 8=Peanuts, 9=Taro, 10= Ginger 11= Potatoes 12=voanemba 13=mananasy 14=other (please specify)…………....	☐ ☐ ☐ ☐	21=Cattle, 22=Goats, 23=Sheep, 24=Pigs, 25= Chicken, 26= Ducks, 27=fish (from farming) 28=goose 29= Dokotra 30= sarin-dokotra 31=Turkey 32=rabbit 33=other (please specify)…….	☐ ☐ ☐ ☐	41= timber, 42=firewood, 43=leaves for fodder 44= leaves for handicrafts, 45= Coffee 46= Cloves 47= fruits (Litchi, oranges, mangos) 48= fruits (Litchi, oranges, mangos) 49= wild roots (Tavolo, Kabija, wild yams), 50= honey 51= guinefowl 52= charcoal 53= Other (please specify)………

24.	**What is the total production in <u>the last 12 months</u> for the three most important crops/ livestock & domestic animals / forest, & tree products [see previous question]?** **And how much of this production is used for own consumption and what for selling and storage?** [use local unit, but convert answers to Kg]			1.PRODUCTION	2.CONSUMPTION	3. SELLING	4. STORAGE
		1. CROP (kg)	1. TOP1				
			2. TOP2				
			3. TOP3				
		2. LIVESTOCK/ DOMESTIC ANMALS (Kg?)	1. TOP1				
			2. TOP2				
			3. TOP3				

		3. FOREST & TREE PRODUCT/WILD ANIMALS (number or liter)	1. TOP1				
			2. TOP2				
			3. TOP3				

PUT HERE THE DETAILS OF CALCULATION THAT LEAD TO THE FIGURES IN ANSWERS OF QUESTION 22.

CROP

TOP1

TOP2

TOP3

LIVESTOCK/DOMESTIC ANIMALS

TOP1

TOP2

TOP3

FOREST/WILD PRODUCTS

TOP1

TOP2

TOP3

25.	How much of your land is …? [ha] (need to add calculation mode in another sheet of paper)		1.OWNED	2. RENTED/OTHERS	3.COMMUNAL	4.STATE owned	
		1.for food crops?					
		1.1. irrigated?					
		1.2 Tavy?					
		1.3 agroforest?					
		2. for grazing?					
		3. forests?					
		4.aquaculture?					
		5. unproductive?					
		6. TOTAL					
26.	How does the overall food production and food security of your household compare with 1 year ago?	☐	Better off .... 3 Same condition .... 2 Worse off .... 1 Don't know ....-9				

Module C:
drivers of change

[We will now focus on the changes that your household has experienced in the last year and that have impacted your livelihoods]

27.	Which of the following changes have negatively impacted your household's livelihood in the last 12 months?		Changes	1. EXPERIENCED 0- NOT Experienced 1. Experienced -9 Don't know	2. TOP 1-3	
		Market/ Governance	1. Low price to sell agricultural products	☐	☐	
			2. Low demand for agricultural products	☐	☐	
			3. Difficult access to agricultural inputs (e.g..fertilizers, pesticides, seeds)	☐	☐	
			4. Low market accessibility (roads, …)	☐	☐	

	And what are the 3 main changes that have most severely affected your household livelihoods in the last 12 months? *[repeat the changes mentioned by the respondent and ask to rank them: mark "1" for top 1, mark "2" for top 2, and mark "3" for top 3]*		5. More restrictive rules for land use/products			
		Climate	6. More unpredictable rainfall (later/earlier start)			
			7. Less overall rainfall/more frequent droughts			
			8. More intense drought			
			9. More overall rainfall/more frequent floods			
			10. More intense floods			
			11. More frequent winds/STRONG WINDs			
			12. More intense winds/STRONG WINDs			
			13. Higher temperatures			
			14. More frequent/intense hail			
			15. More frequent/intense frost			
		Land	16. Land is less productive			
			17. Less productive land available			
		Labor	18. Unable to hire labor because it is too expensive			
			19. Unable to hire labor because it is not available			
		Pests & diseases	20. More agriculture pests/diseases			
			21. New agriculture pests/diseases have come			
			22. More human diseases			
		Other	23. ____________________________			

28.	How many times has	HAZARD	1. TIMES	2. LATEST IN YEAR? YYYY	3. SEVERITY OF THE LATEST EVENT 1=severe, 2=medium, 3=mild

	your household been affected by the following climate-related hazards <u>during the last 5 years?</u> In which year your household was impacted last? Can tell us know severe the latest event was?	1. STRONG WIND Please give name:	☐ ________________	☐☐☐☐	☐
		2. DROUGHT or EXTENDED DRY PERIOD	☐	☐☐☐☐	☐
		3. FLOOD	☐	☐☐☐☐	☐
		4.HAIL	☐	☐☐☐☐	☐
		5.FROST	☐	☐☐☐☐	☐

Module D:
impact of climate change

[We will now continue with questions related to the impact of the climate-related hazards on your household's activities and assets]

		DAMAGE/IMPACT	1. STRONG WIND	2. DROUGHT or EXTENDED DRY PERIOD	3. HAIL	4. FROST	5. FLOOD	
29.	You mentioned in an earlier question that [climate hazard 1, 2,3, 4 and/or 5] have impacted your household. In this question we want to understand how [climate hazard 1, 2,3, 4, 5] that you have experienced in the last 12 months affected your household. Did your household experience any [table items] because of the [climate hazard 1, 2,3, 4, 5] in the last 12 month? If not affected by the climate hazard use the code: -8	1.house						0= Not damaged, 1=roof damaged (slightly) 2=walls (slightly) 3= wall and roof (middle) 4= entirely destroyed -9= don't know
		2.assets/ equipment						0=No damage 1= slightly damaged 2= moderately damaged 3= severely damages -9=don't know
		3.transportation (road/river)						# days of un-operational
		4.crop TOP 1						% harvest decrease
		5. crop TOP 2						% harvest decrease
		6.crop TOP 3						% harvest decrease
		7. .forest & tree TOP 1						% harvest decrease (10% increments)
		8 .forest & tree TOP 2						% harvest decrease (10% increments)
		9. forest & tree TOP 3						% harvest decrease (10% increments)
		10.livestock/domestic animals TOP 1						% of animals dead
		11.livestock/domestic animals TOP 2						% of animals dead

		12.livestock/domestic animals TOP 3	☐	☐	☐	☐	☐	% of animals dead
		13.Injuries/Diseases	☐	☐	☐	☐	☐	# days not able to work (consider all members of the Household)
		14.Loss of school time	☐	☐	☐	☐	☐	# days
		15.Loss of cultural activities/traditions	☐	☐	☐	☐	☐	# days
		16. ____	☐	☐	☐	☐	☐	____
		17. ____	☐	☐	☐	☐	☐	____

30.	List the number of days in each month during which your household did NOT have enough; -food (3 times a day) to feed all members of the household in the <u>last 12 months</u>	JAN [__] FEB [__] MAR [__] APR [__] MAY [__] JUN [__] JUL [__] AUG [__] SEP [__] OCT [__] NOV [__] DEC [__] TOTAL [_____] Codes: # of days without enough food (i.e. <u>3 times per day for ALL household members</u>) [interviewer: if it is hard for the respondent to remember each month – use season or total per year]

31.	List the number of days in each month during which your household your household NOT have enough: - clean water for domestic use during the last 12 months	JAN [__] FEB [__] MAR [__] APR [__] MAY [__] JUN [__] JUL [__] AUG [__] SEP [__] OCT [__] NOV [__] DEC [__] TOTAL [_____] # of days without clean water [interviewer: if it is hard for the respondent to remember each month – use season or total per year]
	- clean water for agricultural uses) during the <u>last 12 months</u>	JAN [__] FEB [__] MAR [__] APR [__] MAY [__] JUN [__] JUL [__] AUG [__] SEP [__] OCT [__] NOV [__] DEC [__] TOTAL [_____] # of days without clean water [interviewer: if it is hard for the respondent to remember each month – use season or total per year]

Module E: Responses to climate-related hazards						
[We are now going to talk about the actions that your household took to respond to climate-related hazards]						
CROP						
32.	How did your household respond to the impacts of climate-related hazards [floods, drought or cyclones] <u>on crop production</u>? [doublecheck for responses that stopped doing something, e.g. stop cultivating specific crops/fields]	stresses	Responses			
		1. Cyclone	1. 2. 3.			
		2. flood	1. 2. 3.			
		3. hail	1. 2. 3.			
		4. Frost	1. 2. 3.			
		5. Drought	1. 2. 3.			

			1.USED 1=YES 0=NO	2. FOR IMPACT OF HAZARD 1=YES 0=NO	3. TOP 1-3	4. if not, MAIN BARRIER (TOP 1-3 only)	
33.	Have you used any of these strategies to reduce risks related to the impacts of flood, droughts or cyclones?? Which ones do you think are the 3 most important to reduce the impact of flood/drought/cyclones on crop production?	1. Soil conservation (Mulching, compositing, organic fertilizers, no-tillage)	☐	CYCL FLO DROU HAIL FROST ☐☐☐☐☐	☐	☐	1 = lack of money, 2 = lack of knowledge/skills,
		2. Agroforestry and tree planting	☐	CYCL FLO DROU HAIL FROST ☐☐☐☐☐	☐	☐	

	[Check for ongoing response strategies not mentioned above. Those that were mentioned in question 29 do not need to be asked again] **What is the main reason why you did not use each of the strategies you considered top 1-3 to reduce the impacts of flood/drought/cyclone in crop production?**	3.	Contour plowing/Terracing		CYCL FLO DROU HAIL FROST			3 = lack of labor,	
		4.	Changed to more resistant crops		CYCL FLO DROU HAIL FROST			4= lack of land access,	
		5.	multi cropping system		CYCL FLO DROU HAIL FROST			5 = lack of technology/tools/infrastructure,	
		6.	Irrigation systems, integrated water management, drainage canals		CYCL FLO DROU HAIL FROST			6= lack of interest/not useful,	
		7.	Off season rice cultivation		CYCL FLO DROU HAIL FROST			7= lack of time,	
		8.	Improvement/creation of grain storage facility		CYCL FLO DROU HAIL FROST			8= other, please specify	
		9.	Integrated pest management		CYCL FLO DROU HAIL FROST			______________	
		10.	Establishment of savings groups.		CYCL FLO DROU HAIL FROST			______________ ______________ ______________ ______________ ______________ ______________ ______________ ______________ ______________	

<table>
<tr><td></td><td colspan="7">LIVESTOCK/
DOMESTIC ANMALS</td><td></td></tr>
<tr><td rowspan="6">34.</td><td rowspan="6">How did your household respond to the impacts of the most recent and severe climate-related hazards [floods, drought or cyclones] <u>on livestock production</u>?

[doublecheck for responses that stopped doing something, e.g. stop herding animals]</td><td>stress</td><td colspan="4">responses</td><td></td><td></td></tr>
<tr><td>1. Cyclone</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>2. FLood</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>3. hail</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>4. Frost</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>5. Drought</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td rowspan="3">35.</td><td rowspan="3">Have you used any of these strategies to reduce risks?
Which ones do you think are the 3 most important to reduce the impact of flood/drought/cyclones on crop production?
[Check for ongoing response strategies not mentioned above. Those that were mentioned in question 29 do not need to be asked again]

What is the main reason why you did not use each of the strategies you</td><td></td><td>1.USED
1=YES
0=NO</td><td>2. FOR IMPACT OF HAZARD
1=YES
0=NO</td><td>3.
TOP
1-3</td><td colspan="2">4.
MAIN BARRIER
(TOP 1-3 only)</td><td></td></tr>
<tr><td>1. Improved animal production through vaccinations, materials for hen houses, complimentary feeding, breed improvement by hybridization</td><td>☐</td><td>CYCL FLO DROU HAIL FROST
☐☐☐☐☐</td><td>☐</td><td>☐</td><td rowspan="2">1 = lack of money,

2 = lack of knowledge/skills,

3 = lack of labor,

4= lack of land access,</td><td></td></tr>
<tr><td>2. Fish farming
(creation of communal fishponds)</td><td>☐</td><td>CYCL FLO DROU HAIL FROST
☐☐☐☐☐</td><td>☐</td><td>☐</td><td></td></tr>
</table>

	considered top 1-3 to reduce the impacts of flood/drought/cyclone in on livestock and domestic animal production?	3.	Diversified livelihoods (Ecotourism, Bee keeping, journeymen/day laborer)	☐	CYCL FLO DROU HAIL FROST ☐☐☐☐☐	☐	☐	5 = lack of technology/tools/infrastructure, 6= lack of interest/not useful, 7= lack of time, 8= other, please specify ________________ ________________ ________________	

<table>
<tr><td></td><td colspan="8">FOREST & TREE PRODUCT/WILD ANIMALS</td></tr>
<tr><td rowspan="6">36.</td><td rowspan="6">How did your household respond to the impacts of climate-related hazards [floods, drought or cyclones] forest & tree products?

[doublecheck for responses that stopped doing something, e.g. harvesting some fruits]</td><td>STRESSES</td><td colspan="4">RESPONSES</td><td></td><td></td></tr>
<tr><td>1. Cyclone</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>2. Flood</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>3. hail</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>4. Frost</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td>5. Drought</td><td colspan="4">1.
2.
3.</td><td></td><td></td></tr>
<tr><td rowspan="3">37.</td><td rowspan="3">Have you been using any of these strategies to reduce risks?
Which ones do you think are the 3 most important to reduce the impact of flood/drought/cyclones on crop production?
[Check for ongoing response strategies not mentioned above. Those that were mentioned in question 29 do not need to be asked again]

What is the main reason why you are not using</td><td></td><td>1.USED
1=YES
0=NO</td><td>2. FOR HAZARD IMPACT
1=YES
0=NO</td><td>3.
TOP
1-3</td><td colspan="2">4.
MAIN BARRIER
(TOP 1-3 only)</td><td></td></tr>
<tr><td>1. Reducing forest degradation</td><td>☐</td><td>CYCL FLO DROU HAIL FROST
☐☐☐☐☐</td><td>☐</td><td>☐</td><td rowspan="2">1 = lack of money,

2 = lack of knowledge/skills,

3 = lack of labor,

4= lack of land access,</td><td></td></tr>
<tr><td>2. Diversification of livelihoods
(e.g bee keeping, making charcoal, fishing crayfish, selling orchid plants and wild fruits, temporary job))</td><td>☐</td><td>CYCL FLO DROU HAIL FROST
☐☐☐☐☐</td><td>☐</td><td>☐</td><td></td></tr>
</table>

	each of the strategies you considered top 1-3 to reduce the impacts of flood/drought/cyclone in crop production?	3. Improving market products	☐	CYCL FLO DROU HAIL FROST ☐ ☐ ☐ ☐ ☐	☐	☐	5 = lack of technology/tools/infrastructure, 6= lack of interest/not useful, 7= lack of time, 8= other, please specify	

Module F:
Food Security

[In this part of the interview we want to understand your household food consumption and how it has changed through time]

38.	How many days did the members of your household eat the following food items, prepared and/or consumed at home, <u>in the last 30 days</u>? *If hard to remember, check for the last 7 days and multiple by 4, if answer is 0 for the last 7 days, check for the whole month*	**# of days** eaten *(0 if not consumed)*
1	**Cereals, grains, roots and tubers** Rice, pasta, bread, sorghum, millet, maize, fonio, potato, yam, cassava, white sweet potato, breadfruit, cooked banana)	☐
2	**Legumes / nuts :** beans, cowpeas, peanuts, lentils, nut, soy, pigeon pea and / or other nuts	☐
3	**Milk and other dairy products**: fresh milk / sour, yogurt, cheese, other dairy products (Exclude margarine / butter or small amounts of milk for tea / coffee)	☐
4	**Meat, fish and eggs:** goat, beef, chicken, pork, blood, fish, including canned tuna, escargot, and / or other seafood, eggs (meat and fish consumed in large quantities and not as a condiment)	☐ If 0 skip to Q 5
4.1	**Flesh meat:** **b**eef, pork, lamb, goat, rabbit, chicken, duck, other birds, insects, bush meat	☐
4.2	**Organ meat:** liver, kidney, heart and / or other organ meats	☐
4.3	**Fish/shellfish:** fish, including canned tuna, escargot, and / or other seafood (fish in large quantities and not as a condiment)	☐
4.4	**Eggs**	☐
5	**Vegetables and leaves:** spinach, onion, tomatoes, carrots, peppers, green beans, lettuce, etc	☐ If 0 skip to Q6
5.1	**Orange vegetables (vegetables rich in Vitamin A):** carrot, red pepper, pumpkin, orange sweet potatoes,	☐
5.2	**Green leafy vegetables:** spinach, broccoli, amaranth and / or other dark green leaves, cassava leaves, sweet potato leaves, moringa levels, palm of the heart	☐
6	**Fruits:** banana, litchi, jackfruit, apple, lemon, mango, papaya, apricot, peach, etc	☐ If 0 skip to Q7
6.1	**Orange fruits (Fruits rich in Vitamin A):** mango, papaya, apricot, peach	☐

7	**Oil / fat / butter:** vegetable oil, palm oil, shea butter, margarine, other fats / oil	☐
8	**Sugar, or sweet:** sugar, honey, jam, cakes, candy, cookies, pastries, cakes and other sweet (sugary drinks)	☐
9	**Condiments / Spices:** tea, coffee / cocoa, salt, garlic, spices, yeast / baking powder, lanwin, tomato / sauce, meat or fish as a condiment, condiments including small amount of milk / tea coffee. Ve tsin	☐

Food Security

39. Food items [enumerators will do most of the calculations. Please just check if the HH bought products, which ones, how many times, and prices (the prices should be checked with local market).	1. **Did you purchase any of the following items during the last 30 days for domestic consumption?** If **'no'**, enter '0' and proceed to next food-item. If '**yes**', ask to estimate the total cash and credit expenditure.		2. **During the last 30 days did your household consume the following foods without purchasing them?** Check question 37 and for consumed items, ask to estimate the value of the non-purchased food items
	1. cash (local currency)	2. credit (local currency)	3. value (local currency)
1. Cereals (maize, rice, sorghum, wheat, bread)			
2. Tubers (sweet potatoes, cassava)			
3. Pulses (beans, peas, groundnuts)			
4. Fruits & vegetables			
5. Fish/Meat/Eggs/poultry			
6. Oil, fat, butter			
7. Milk, cheese, yogurt			
8. Sugar/Salt			
9. Tea/Coffee			
10. Other meals/snacks consumed outside the home			

Household Expenditure

40	1. **Did you purchase the following items during the last 30 days for domestic/own consumption?**	[enumerators will do most of the calculations. Please just check if the HH bought products, which ones, how many times, and prices (the	2. **In the last 6 months how much money have you spent on each of the following items or service?**	[enumerators will do most of the calculations. Please just check if the HH bought products, which ones, how many times, and prices (the

	If none, write 0	prices should be checked with local market)] Estimated expenditure (local currency)		*If none, write 0.*	prices should be checked with local market)] Estimated expenditure (local currency)
1	Alcohol/Palma wine & Tobacco		9	Medical expenses, health care	
2	Soap & HH items		10	Clothing, shoes	
3	Transport		11	Education, school fees, uniform,	
4	Fuel (wood, paraffin, etc.)		12	Debt repayment	
5	Water		13	Celebrations / social events	
6	Electricity/Lighting		14	Agricultural inputs	
7	Communication (phone)		15	Savings	
8	Rent		16	Constructions/house repairs	

Livelihood-based coping strategies		
41. During the past 30 days, did your household engage in any following behaviors due to a lack of food or a lack of money to buy food?		0 = No, because I did not face a shortage of food 1 = No, because I already sold those assets or have engaged in this activity within the last 12 months and cannot continue to do it 2= Yes
1.1 stress	Spent savings or borrowed money, sold small assets for food or repairing	☐
1.2 stress	Reduced meals quantities/times or borrowed food or eaten elsewhere	☐
1.3 stress	Harvested wild food	☐
1.4 stress	Changed seed varieties, land management changes	☐
1.5 crisis	Withdrew children from school	☐
1.6 crisis	harvested immature crops (e.g. green maize) or eat seed for future planting	☐
1.7 crisis	Sold productive assets or drastically reduce their use (bicycle, machines, fertilizers)	☐
1.8 emergency	Sold or abandoned land or building	☐
1.9 emergency	Sold last female animal or last seeds reserves	☐
1.10 emergency	Begged	☐
1.11	Others	

Module G: Climate Awareness and Communication				
	[In this part of the interview we want to understand what you think about climate-related natural hazards]			
42.	Did your household have access to weather forecast services (including preventive information on potential climatic threats) in the past 12 months?	1. Did you receive any information?	☐	yes......1 no 0
		2. How did you receive the information?	☐ ☐	Radio......1 phone......2 newspaper/printed info......3 TV......4 internet......5 voice by Government Leader ......6 VOI or other Association member ......7 Family or Friends......8 NGO 9
		3. Did it include advice on how to use the information in your farming?	☐	yes......1 not......0
		4. Did you modify your agricultural practice according to the weather forecast services?	☐	yes......1 no 0
		5. If yes, How?		
43.	Can you describe or give an example of what do you understand with the following expressions? [write down the answers and code accordingly]	1. "Climate Change"	☐	Assessment CODE 0= do not understand 1=more or less correct 2= fully understand
		2. "the impact of Climate Change"	☐	

		3.	“Nature can help people to respond, adapt, and be less vulnerable to Climate Change”			

<table>
<tr><th colspan="5"><u>Module H:</u>
Mitigation</th></tr>
<tr><td colspan="5">[In this part of the interview we want to understand what you think about the causes of natural hazards]
[explain to the farmers that the answers here can help improve project activities, they can be honest and should not be afraid of retaliation, as they name and household location are considered confidential information]</td></tr>
<tr><td>44.</td><td>How the <u>quantity</u> of the forested area [=deforestation] around your village has changed in the <u>past 5 years (base-line)/last 12 months (mid endline)</u>?</td><td>☐ [ ] (5) greatly increased
[ ] (4) slightly increased
[ ] (3) about the same
[ ] (2) slightly decreased
[ ] (1) greatly decreased</td><td><u>2. Why?</u></td><td></td></tr>
<tr><td>45.</td><td>How the <u>quality</u> of forested area [=degradation] around your village has changed in the <u>past 5 years (base-line)/last 12 months (mid endline)</u>?</td><td>☐ [ ] (5) greatly increased
[ ] (4) slightly increased
[ ] (3) about the same
[ ] (2) slightly decreased
[ ] (1) greatly decreased</td><td><u>2. Why?</u></td><td></td></tr>
<tr><td rowspan="3">46.</td><td rowspan="3">What is the main cause of deforestation or forest degradation for the forests near your village?</td><td>1. What is the main cause of deforestation or forest degradation for the forests near your village?</td><td>☐</td><td>shifting cultivation (tavy) 1
cropping.. 2
tree plantation.. 3
pasture.. 4
non-agricultural uses (e.g. urban) 5
timber extraction...................................... 6
fire wood / charcoaling / NTFP 7
natural hazards (fires, storms, …)............ 8
other specify...</td></tr>
<tr><td>2. How satisfied are you with the level of protection of CAZ/COFAV forest corridor (regulations, patrolling and monitoring, law enforcement)?</td><td>☐</td><td>1=Not at all satisfied
2=Slightly satisfied
3=Moderately satisfied
4=Very satisfied
5=Extremely satisfied</td></tr>
<tr><td>3. Why?</td><td colspan="2"></td></tr>
<tr><td>47.</td><td>What do you think about people conducting illegal activities in the protected area?</td><td>☐ it is never OK 1
it is sometimes/
under certain circumstance OK 2
it is always OK .... 3</td><td colspan="2"></td></tr>
</table>

48.	Have you ever reported a violation of the rules to the VOI/authorities?	☐ Yes, always ....2 Yes, sometimes..1 no 0	2. Why not?
49.	Are you now relying more or less on protected areas for food and income, compared to one year ago?	☐ 5= relying a lot more 4= relying slightly more 3= about the same 2= relying slightly less 1=relying a lot less	3. Why?
50.	Are there key forest areas that should be restored or protected, because they are important for helping you during climate-related hazard?	☐ yes .... 1 no 0	If yes, where? LOCATION NAME
51.	How important is VOI to help manage the forests and natural resources more sustainably and equitably?	☐ 5= extremely important 4= important 3= average importance 2= of little importance 1= not at all important	
52.	How do you consider your voice heard in the VOI/ do you have a say in decision making?	**Man** ☐ 0=no 1=sometimes/partially 2=yes	**Woman** ☐ 0=no 1=sometimes/partially 2=yes

Module I: Markets

	[In this part of the interview we want to understand the market of agricultural/forest products]			
53.	Where do your household members sell the agricultural or forest products, if sold? 1. Market 1	1. NAME	2. TYPE 3. DISTANCE	Market outside the village .... 1 Groceries at the village .... 2 communal market .... 3 itinerant collector...................................... 4 cooperative... 5 along the road..6 Not sold... 7 [minutes] from household with usual transportation system
	2. Market 2 (if any)	1. NAME	2. TYPE 3. DISTANCE	Not sold... 0 market outside the village .... 1 Groceries at the village .... 2 communal market .... 3 itinerant collector...................................... 4 cooperative... 5 [minutes] from household with usual transportation system
54.	What is the biggest barrier to sell your products?			
55.	Do your household conduct any activity to improve the value of the products you sell? If yes, what do you do?	1. 0=no 1= yes	2.	

56.	Did your household have access to information on market & prices during the last 12 months?	1.	Did you receive any information?	☐	yes .... 1 no .... 0 Other................ 2
		2.	How did you receive the information?	☐	Radio .... 1 phone .... 2 newspaper/printed info .... 3 TV .... 4 internet .... 5 voice by Government Leader................ 6 VOI or other Association member................ 7 Family or Friends .... 8 NGO................ 9 House of commerce................10 Other................11
		3.	Did it include advice on how to use the information in your product?	☐	yes .... 1 not 0
		4.	Did you modify your agricultural practice according to this information?	☐	yes .... 1 no 0
		5.	If yes, How?		
57.	Are you or any of member of your household part of the following type of organizations?		NAME:		YES=1 NO=0
		1.	VOI/VOI (forests association)		☐
		2.	Farmers' association or group		☐
		3.	Tree nursery/tree planting		☐
		4.	Fish/Fisheries		☐
		5.	Forest products collection		☐

		6. Water management/Irrigation	☐
		7. Savings and/or credit	☐
		8. Marketing agricultural products (i.e. livestock, crops, tree or fish)	☐
		9. Productivity enhancement (i.e. livestock, crops, trees or fish)	☐
		10. Women's group	☐
		11. Youth group	☐
		12. Local Committee for Disaster and Risk Management)	☐
		13. Any other org/group (link to church, political, etc.)	☐

Module J: ASSETS and INPUTS

[In this part of the interview we are going to ask you about assets of your household]

58.	Do you own the following items?	**COMMUNICATION**	YES=1 NO=0
		1. Mobile phone	☐
		2. Radio	☐
		3. Television	☐
		4. Internet access	☐
		5. Mobile banking	☐
		6. VHS reader	☐
		7. Amplifier	☐
		HOUSE	
		8. Bed	☐

		9. Sewing Machine	☐
		10. Generator (groupe)	☐
		11. Petrol Lamp	☐
		12 Solar panel	☐
		13. Improved cooking stoves	☐
		AGRICULTURE	
		14. Cleaver (big knife)	☐
		15. Machete	☐
		16. Plough (charrue)	☐
		17. Chainsaw	☐
		18. storage room/facilities	☐
		19. motor pump	☐
		20. sprayer	☐
		21. rice husker	☐
		22. kibota	☐
		23. Herse	☐
		24. Watering canister	☐
		TRANSPORTATION	
		25. Tractor or motoculteur	☐
		26. Bicycle	☐
		27. Motorcycle/Moped	☐
		28. Oxcart	

		29- Lorry/ 4*4	☐
		30 Other …………………………………………………	
59.	When you worked on your field, how many persons per day on average contributed to the land preparation (planting and taking care)?	1. __|__ PEOPLE/day (average) (rice) 2. __|__ DAYS (rice)	__|__ PEOPLE/day (average) (other crops) __|__ DAYS (other crops)
60.	When you worked on your field, how many persons per day on average contributed to the land harvest and processing?	1. __|__ PEOPLE/day (average) (rice) 2. __|__ DAYS (rice)	__|__ PEOPLE/day (average) (other crops) __|__ DAYS (other crops)

c. Appendix 3 : List of forest to be restored

Appendix table 119. Location name of forest to be restored in CAZ and COFAV

CAZ/ COFAV	Commune name	Fokontany name	Association name	Location name
CAZ	Fierenana	Sahanomana	3SI	Andafy Atsinanana
CAZ	Fierenana	Sahanomana	3SI	Bemandotra
CAZ	Fierenana	Sahanomana	3SI	Anjirobe
CAZ	Fierenana	Sahanomana	3SI	Ambatobe 1
CAZ	Fierenana	Sahanomana	3SI	Andobotsiriry
CAZ	Fierenana	Sahanomana	3SI	Manadolotra
CAZ	Ambohimanana	Morarano Gara	AMBAHIVOLA	Ankerana
CAZ	Ambohimanana	Morarano Gara	AMBAHIVOLA	Belanera
CAZ	Fetraomby	Ambodikily	ANDRIANTANTELY	Andranomena
CAZ	Fetraomby	Ambodikily	ANDRIANTANTELY	Ampasimpotsy
CAZ	Maroseranana	Ambodilendemy	EFTIAMA	Sahamamy
CAZ	Beforona	Ambohimarina	FANDREFIALA	Vohitratody
CAZ	Beforona	Ambohimarina	FANDREFIALA	Bekitrana
CAZ	Beforona	Ambohimarina	FANDREFIALA	Vohidrazana
CAZ	Beforona	Ambohimarina	FANDREFIALA	Ranomena
CAZ	Beforona	Ambohimarina	FANDREFIALA	Vohidrazana Andrefana
CAZ	Fierenana	Ampatakana	FANDREFIALA II	Manandolotra
CAZ	Fierenana	Ampatakana	FANDREFIALA II	Ampasatsimivalo
CAZ	Maroseranana	Bezono	FANILO	Ankofomaina
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Ambetsitsoraka
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Mahambo
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Ambodimanga
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Andasifanovo
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Fempona
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Antanadolo Be
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Masokoamena
CAZ	Morarano- Gare	Morarano Gara	FANIRY	Antsinanan Ny Amborompotsiny
CAZ	Fierenana	Amparihivola	FARIHIVOLA	Ampasina
CAZ	Fierenana	Amparihivola	FARIHIVOLA	Antainandrano
CAZ	Ambodilazana	Morarano Gara	FIARENANA	Vatovanda
CAZ	Fierenana	Ampatakana	FIMIFAMA	Ankobana
CAZ	Andasibe	Ampangalatsary	FIRAISANKINA	Andravomana
CAZ	Andasibe	Ampangalatsary	FIRAISANKINA	Vohidrazana
CAZ	Andasibe	Ampangalatsary	FIRAISANKINA	Maromizaha
CAZ	Andasibe	Ampangalatsary	FIRAISANKINA	Moala
CAZ	Andasibe	Ampangalatsary	FIRAISANKINA	Iaroka
CAZ	Lakato	Ambodigavo	FITAMALS	Betsingita

CAZ	Lakato	Ambodigavo	FITAMALS	Fanjavola, Ambodinonoka
CAZ	Lakato	Ambodigavo	FITAMALS	Tsimenarano
CAZ	Lakato	Ambodigavo	FITAMALS	Sahabemenarano
CAZ	Morarano- Gare	Morarano Gara	FITAMIA	Ampandihizana
CAZ	Morarano- Gare	Morarano Gara	FITAMIA	Ambohimaranitra
CAZ	Morarano- Gare	Morarano Gara	FITAMIA	Ambodimanga
CAZ	Lakato	Ambodigavo	FMFHV	Fanjavola
CAZ	Lakato	Ambodigavo	FMFHV	Sahamenaraony
CAZ	Lakato	Ambodigavo	FMFHV	Sahapota
CAZ	Lakato	Ambodiriana	FMFHV	Ambodikijy
CAZ	Manakambahiny-Est	Andemademaka	LOVASOA I	Ambohijanahary
CAZ	Manakambahiny-Est	Andemademaka	LOVASOA I	Ambodiriandehibe
CAZ	Morarano- Gare	Ambohindray	M.M.A	Ambolobe
CAZ	Morarano- Gare	Morarano Gara	MAMELONTSOA	Ampasina
CAZ	Morarano- Gare	Morarano Gara	MAMELONTSOA	Andasibe
CAZ	Morarano- Gare	Morarano Gara	MAMELONTSOA	Zahamena
CAZ	Morarano- Gare	Morarano Gara	MAMI	Ranofitsindronanana
CAZ	Morarano- Gare	Morarano Gara	MAMI	Andasin'Ilay Paroratra
CAZ	Morarano- Gare	Morarano Gara	MAMI	Maroala Andrefana
CAZ	Morarano- Gare	Morarano Gara	MAMI	Amborompotsy
CAZ	Morarano- Gare	Morarano Gara	MAMI	Mafaitra
CAZ	Antenina	Sahavazina	MANANDRIANA CENTRE	Sahavorina
CAZ	Antenina	Sahavazina	MANANDRIANA CENTRE	Ditsaka
CAZ	Fierenana	Fierenana	MIAVOTRA	Karahatra
CAZ	Fierenana	Fierenana	MIAVOTRA	Zanaka Renila
CAZ	Fierenana	Fierenana	MIAVOTRA	Sanimana Centre
CAZ	Fierenana	Fierenana	MIAVOTRA	Anjanahary Be
CAZ	Beforona	Ambatoharanana	RANOALA	Mahasoa
CAZ	Beforona	Ambatoharanana	RANOALA	Andranomenabe
CAZ	Beforona	Ambatoharanana	RANOALA	Ambodiriana
CAZ	Maroseranana	Andeka	RAVINALA	Betaolandambo
CAZ	Maroseranana	Andeka	RAVINALA	Vohitrikina
CAZ	Morarano- Gare	Andrindra	RAVINALA	Antanatolobe
CAZ	Morarano- Gare	Morarano	RAVINALA	Amboasarimaty
CAZ	Morarano- Gare	Morarano Gara	RAVINALA	Antanatolola
CAZ	Morarano- Gare	Morarano Gara	RAVINALA	Antanatolobe
CAZ	Morarano- Gare	Morarano Gara	RAVINALA	Maomahatsinjo
CAZ	Antenina	Fotsialanana	SIMPONA	Lohan'Ny Trongeteza
CAZ	Antenina	Fotsialanana	SIMPONA	Vohibatra
CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Ambato
CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Betsingilo

CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Sahamaintso
CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Sahanody
CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Ampasina
CAZ	Morarano- Gare	Morarano Gara	TELOMIRA	Sandimena
CAZ	Fierenana	Amboanjo	VONONA	Bejombo
CAZ	Fierenana	Amboanjo	VONONA	Ranofotsy
CAZ	Fierenana	Amboanjo	VONONA	Mandasisoa
CAZ	Fierenana	Amboanjo	VONONA	Ampasina
CAZ	Fierenana	Amboanjo	VONONA	Beampopo
CAZ	Ambohimanana	Manankasina	VOROMAHERY	Angadana
COFAV	Androy	Ambatovaky	3FT	Sahafotobe
COFAV	Androy	Ambatovaky	3FT	Sahafodibe
COFAV	Androy	Ambatovaky	3FT	Ankirepo
COFAV	Androy	Ambatovaky	3FT	Ambatongehana
COFAV	Androy	Ambatovaky	3FT	Andragnaroa
COFAV	Androy	Ambatovaky	3FT	Alan'Ny Sahavondronana
COFAV	Androy	Ambatovaky	3FT	Ambatofahangenana
COFAV	Androy	Ambatovaky	3FT	Vatovavy
COFAV	Androy	Ambatovaky	3FT	Ampasamborizany
COFAV	Androy	Ambatovaky	3FT	Sahamamy
COFAV	Androy	Ambatovaky	3FT	Ankofafarano
COFAV	Androy	Ambatovaky	3FT	Al A Arovana
COFAV	Miarinarivo	Miarinarivo	AMBOHIBALO MIRAY	Ankaramena
COFAV	Miarinarivo	Miarinarivo	AMBOHIBALO MIRAY	Andranomafana
COFAV	Miarinarivo	Miarinarivo	AMBOHIBALO MIRAY	Ankarasada
COFAV	Miarinarivo	Miarinarivo	AMBOHIBALO MIRAY	Andremena
COFAV	Miarinarivo	Soamanandrariny	AMBOHIBALO MIRAY	Ampahadrano
COFAV	Ikongo	Ambalagoavy	ANALAMANITRA	Antampon'Itsiandanitr a
COFAV	Ikongo	Ambalagoavy	ANALAMANITRA	Andohaniharagnony
COFAV	Ikongo	Ambalagoavy	ANALAMANITRA	Tsiandanitra
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Lambohazo
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Matikitiky
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Rotry
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Ampilankazary
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Plakazary
COFAV	Vohimary Sud	Antemafalandro	ANTEMANANA MIRAY	Bevagna
COFAV	Vohiboreka	Maroangira	AVOTRA	Ankombo
COFAV	Vohiboreka	Maroangira	AVOTRA	Sahorihy
COFAV	Ivohibe	Ivohibe Nord	AVOTRA IVB	Ankitoky
COFAV	Ivohibe	Ivohibe Nord	AVOTRA IVB	Ambato
COFAV	Ivohibe	Ivohibe Nord	AVOTRA IVB	Ambihilambo
COFAV	Ivohibe	Ivohibe Nord	AVOTRA IVB	Ambarazy

COFAV	Mahazoarivo	Mahatsara	FAHAZAVANA ANTANINARY	Tandrakevo
COFAV	Mahazoarivo	Mahatsara	FAHAZAVANA ANTANINARY	Aborano
COFAV	Mahazoarivo	Mahatsara	FAHAZAVANA ANTANINARY	Mahanara
COFAV	Mahazoarivo	Mahatsara	FAHAZAVANA ANTANINARY	Maromana
COFAV	Ivongo	Anaviavy	FANDROSOANA	Anaviavy
COFAV	Ivongo	Anaviavy	FANDROSOANA	Ambatoharanana
COFAV	Ivongo	Anaviavy	FANDROSOANA	Manangosoa
COFAV	Ivongo	Anaviavy	FANDROSOANA	Ambatoety
COFAV	Ivongo	Anaviavy	FANDROSOANA	Antakotraka
COFAV	Ivongo	Anaviavy	FANDROSOANA	Betrangihazo
COFAV	Ivongo	Anaviavy	FANDROSOANA	Matahateny
COFAV	Ivongo	Anaviavy	FANDROSOANA	Betrongikazo
COFAV	Ikongo	Ambalagoavy	FARITRA	Madiorano
COFAV	Vohimary Sud	Antesonjo	FIAMA	Sahafosa
COFAV	Vohimary Sud	Antesonjo	FIAMA	Madiolanitra
COFAV	Vohimary Sud	Antesonjo	FIAMA	Tanana Kalanga
COFAV	Vohimary Sud	Antesonjo	FIAMA	Mahafasa
COFAV	Vohimary Sud	Antesonjo	FIAMA	Bezavo
COFAV	Vohimary Sud	Antesonjo	FIAMA	Vangay
COFAV	Vohimary Sud	Antesonjo	FIAMA	Tanana Kalanga
COFAV	Tolongoina	Madiorano	FIAMA AVO	Ambaroandrano
COFAV	Ivohibe	Andongy	FIAROVA	Andongondongo
COFAV	Ivohibe	Andongy	FIAROVA	Manolombo
COFAV	Moroteza	Tanambao	FIKAMBANANA ANTEFAMOA MAHARITRA	Samboara
COFAV	Moroteza	Tanambao	FIKAMBANANA ANTEFAMOA MAHARITRA	Antefamoa
COFAV	Vohimary Sud	Antevolozatsy	FIKAMBANANA TENA MANDROSO	Alazatora
COFAV	Vohimary Sud	Antevolozatsy	FIKAMBANANA TENA MANDROSO	Agnakofa
COFAV	Vohimary Sud	Antevolozatsy	FIKAMBANANA TENA MANDROSO	Ivasia
COFAV	Tolongoina	Andrambovato	FIMAA	Lavakoa
COFAV	Tolongoina	Andrambovato	FIMAA	Ambatomialoha
COFAV	Tolongoina	Andrambovato	FIMAA	Ambonin'Ny Fiangonana
COFAV	Tolongoina	Andrambovato	FIMAA	Ambalavero
COFAV	Tolongoina	Andrambovato	FIMAA	Kapoka
COFAV	Tolongoina	Andrambovato	FIMAA	Amboatomeloha
COFAV	Tolongoina	Andrambovato	FIMAA	Marohala
COFAV	Tolongoina	Andrambovato	FIMAA	Anjahana
COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Analamaloka
COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Ankofafa
COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Maroangavo
COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Mandrizavo
COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Ankofafa

COFAV	Ankarimbelo	Faliarivo	FIRAISANTSOA	Ingidy
COFAV	Ambohimahamasin a	Lomaka	FITAMITO	Andoasaha
COFAV	Ambohimahamasin a	Lomaka	FITAMITO	Iharongana
COFAV	Ambohimahamasin a	Lomaka	FITAMITO	Apepy
COFAV	Ambohimahamasin a	Lomaka	FITAMITO	Tharangara
COFAV	Ambohimahamasin a	Lomaka	FITAMITO	Lomaka
COFAV	Tolongoina	Miandriandry	FITEHIMA	Antohafana
COFAV	Tolongoina	Miandriandry	FITEHIMA	Marovenka
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Rajo
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Vinanto
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Ambatomanonga
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Ankofa
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Soamanara
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Ambatomitongoa
COFAV	Ivato	Amboangy	FOKONOLONA VONONA HANDROSO	Ankofa
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Antsinanan'Ny Tanana
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Ampilambata
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Tsitondroana
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Marorana
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Andraitsiary
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Tobinolomangataka
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Andohavohitra
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Antandrokomby
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Ambalakizitina
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Marorana
COFAV	Alatsinainy Ialamarina	Ranomena Gara	IMAINTSOANALA	Kelilanitra
COFAV	Ikongo	Antehikoho	ISITRAKE	Andranomalemy
COFAV	Ikongo	Antehikoho	ISITRAKE	Antampon'I Kaina
COFAV	Ikongo	Antehikoho	ISITRAKE	Ambakoagna
COFAV	Ikongo	Antehikoho	ISITRAKE	Andoahn'I Sahavia
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Ambohitrorohoro

COFAV	Ankarimbelo	Iarinomby	LOHAONY	Agnalaela
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Kinahy
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Alakatoa
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Andaza
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Andray
COFAV	Ankarimbelo	Iarinomby	LOHAONY	Andohan'I Matatana
COFAV	Ambohimahamasin a	Andohanimananatan a	LOVASOA	Ampitarafa
COFAV	Ambohimahamasin a	Andohanimananatan a	LOVASOA	Alam'Ambondrombe
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Ambarazy
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Ampilambolo
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Anosibary
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Andranomiditra
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Analatelo
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Ambarazy
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Ampilambolo
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Ambony Antsinana
COFAV	Ivohibe	Ivohibe Nord	LOVASOA IVB	Antsinan'I Maromainty
COFAV	Ambohimitombo I	Ambohimanarivo	LOVATSARAINDRINDRA	Lohonoka
COFAV	Manambidala	Madiorano	MADIORANO MAHOMBY	Tsitondroy
COFAV	Manambidala	Madiorano	MADIORANO MAHOMBY	Tsizaray
COFAV	Manambidala	Madiorano	MADIORANO MAHOMBY	Veoveombe
COFAV	Manambidala	Madiorano	MADIORANO MAHOMBY	Bezavo
COFAV	Moroteza	Emita	MAHASOA	Tsiagnimbola
COFAV	Moroteza	Emita	MAHASOA	Mandia
COFAV	Moroteza	Emita	MAHASOA	Iambomary
COFAV	Ambolomadinika	Tsianivoha	MAHATSINJO	Andohan'I Manambondro
COFAV	Ambolomadinika	Tsianivoha	MAHATSINJO	Tampon'Ihono
COFAV	Ambolomadinika	Tsianivoha	MAHATSINJO	Kianjavato
COFAV	Ambolomadinika	Tsianivoha	MAHATSINJO	Ankaramena
COFAV	Ivongo	Sakaroa	MAHAVELO ANOSIVELO	Anala Maizy
COFAV	Ivongo	Sakaroa	MAHAVELO ANOSIVELO	Anosivelo Avaratra
COFAV	Ivongo	Sakaroa	MAHAVELO ANOSIVELO	Sambalahy
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Ignivoia
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Ambatofotsy
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Ambaribe
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Maharanga
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Vohibonitry
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Ngidy
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Mandrizavona
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Vangaindrano
COFAV	Ankarimbelo	Faliarivo	MAINTIMBAHITRA	Mahavelo

COFAV	Tolongoina	Madiorano	MAINTSOANALA	Mandraivelo
COFAV	Tolongoina	Madiorano	MAINTSOANALA	Marolambo
COFAV	Antodinga	Mamolifoly	MAMIA	Fantritra
COFAV	Antodinga	Mamolifoly	MAMIA	Andasinambaniandro
COFAV	Antodinga	Mamolifoly	MAMIA	Mahono
COFAV	Antodinga	Mamolifoly	MAMIA	Sahamaloto
COFAV	Antodinga	Mamolifoly	MAMIA	Afatsitra
COFAV	Antodinga	Mamolifoly	MAMIA	Tsiapoindrano
COFAV	Antodinga	Mamolifoly	MAMIA	Ankifafa
COFAV	Ivato	Ambohitsara	MANDROSO	Marosono
COFAV	Ivato	Ambohitsara	MANDROSO	Vetsondro
COFAV	Ivato	Ambohitsara	MANDROSO	Sahamamy
COFAV	Ivato	Ambohitsara	MANDROSO	Vetsondrano
COFAV	Ivato	Ambohitsara	MANDROSO	Ambatomitongoa
COFAV	Ivato	Ambohitsara	MANDROSO	Ambolakevo
COFAV	Ivato	Ambohitsara	MANDROSO	Angilobe
COFAV	Ivato	Ambohitsara	MANDROSO	Vohitrandro
COFAV	Ikongo	Antsatrana	MANEVA	Ambalatenina
COFAV	Ikongo	Antsatrana	MANEVA	Andasy
COFAV	Ikongo	Antsatrana	MANEVA	Tsiragnamasy
COFAV	Vondrozo	Antevongo	MAROMANIRY	Bezavo
COFAV	Vondrozo	Antevongo	MAROMANIRY	Bezavo
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Ankaramalaza
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Marovata
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Vohibolo
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Nakahara
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Anenjadava
COFAV	Mahazoarivo	Mahatsara	MAROMANITRA MANDROSO	Besofy
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Sahasiny
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Maroala
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Vohitsoa
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Ankazobe
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Mihony
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Ankazobe
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Tsazomboro
COFAV	Ambolomadinika	Tsianivoha	MIAVONTENA	Mihano
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Nosy Be
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Ranomandry
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Ihoramaro
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Ranomandry
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Tsirity
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Antananaolo
COFAV	Namoly	Namoly Est	MIORA ATSIMO	Analavory

COFAV	Namoly	Namoly Centre	MIORA AVARATRA	Analandambo
COFAV	Namoly	Namoly Centre	MIORA AVARATRA	Sahalava
COFAV	Namoly	Namoly Est	MIORA AVARATRA	Betavony
COFAV	Namoly	Namoly Est	MIORA AVARATRA	Andohabatomitsangana
COFAV	Sendrisoa	Amindranjamanony	MIORA AVARATRA	Ambanin'Ny Manara
COFAV	Sendrisoa	Amindranjamanony	MIORA AVARATRA	Ambanin'Ny Manara
COFAV	Sendrisoa	Amindranjamanony	MIORA AVARATRA	Ampantrana
COFAV	Sendrisoa	Amindranjamanony	MIORA AVARATRA	Sakalahy
COFAV	Sendrisoa	Amindranjamanony	MIORA AVARATRA	Ambatolahimaro
COFAV	Ikongo	Antehikoho	MIRAY	Ambadogadoa
COFAV	Ikongo	Antehikoho	MIRAY	Sahanomby
COFAV	Ikongo	Antehikoho	MIRAY	Agnaramena
COFAV	Ampatsy Ampangabe	Ampatsy	MITSINJO	Ampasina
COFAV	Ampatsy Ampangabe	Ampatsy	MITSINJO	Vatoavo
COFAV	Ampatsy Ampangabe	Ampatsy	MITSINJO	Amboavoa
COFAV	Ambohimitombo I	Ambohimanjaka	RAVAKINIALA	Andafirano
COFAV	Ambohimitombo I	Ambohimanjaka	RAVAKINIALA	Sahanjavy
COFAV	Ambohimitombo I	Ambohimanjaka	RAVAKINIALA	Volamena
COFAV	Ivongo	Sakaroa	SAKAROA MANDROSO	Marovato
COFAV	Ivongo	Sakaroa	SAKAROA MANDROSO	Bejeny
COFAV	Ivongo	Sakaroa	SAKAROA MANDROSO	Atsaha Sakaroa
COFAV	Ivongo	Sakaroa	SAKAROA MANDROSO	Ambatolahimaro
COFAV	Moroteza	Bemahala	SAMBOARAN'NY FAMPANDROSOANA	Ranofady
COFAV	Moroteza	Miarinarivo	SAMBOARAN'NY FAMPANDROSOANA	Ankirimaso
COFAV	Moroteza	Miarinarivo	SAMBOARAN'NY FAMPANDROSOANA	Iambovelo
COFAV	Tolongoina	Andrambovato	TAFITA	Tanambao
COFAV	Tolongoina	Andrambovato	TAFITA	Tatamaly
COFAV	Tolongoina	Andrambovato	TAFITA	Ampiho
COFAV	Ankazotsararavina	Ranomena	TAFITASOA RANOMENA FIRAISANA	Ndrianarivony
COFAV	Ankazotsararavina	Ranomena	TAFITASOA RANOMENA FIRAISANA	Antsaonjo
COFAV	Ambohimana	Tsaratanana	TSARAMANDROSO	Marobakaka
COFAV	Ambohimana	Tsaratanana	TSARAMANDROSO	Agnakona
COFAV	Ambohimana	Tsaratanana	TSARAMANDROSO	Voromihaika
COFAV	Moroteza	Ivato	TSARAMANDROSO MTZ	Malamavato
COFAV	Ampatsy Ampangabe	Ambalaivo	TSIMANAVAKA	Andasy Atsimo
COFAV	Ampatsy Ampangabe	Ambalaivo	TSIMANAVAKA	Andasy Avaratra
COFAV	Ampatsy Ampangabe	Ambalaivo	TSIMANAVAKA	Ampihinananotrika

COFAV	Ampatsy Ampangabe	Ambalaivo	TSIMANAVAKA	Ambalavelona
COFAV	Vinanitelo	Sandranata	VINANASA	Andrarambinombe
COFAV	Vinanitelo	Sandranata	VINANASA	Vohenjana
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Mahafaly
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Androboka
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Befamato
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Ampasimbaventy
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Ankofafa
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Ampasimbaventy
COFAV	Vinanitelo	Vinanitelo Est	VINANASA	Anosy
COFAV	Ankarimbelo	Ankarimbelo	VINANINONY	Avaradrano
COFAV	Ankarimbelo	Ankarimbelo	VINANINONY	Rejakely
COFAV	Ankarimbelo	Ankarimbelo	VINANINONY	Rejabe
COFAV	Ankarimbelo	Ankarimbelo	VINANINONY	Sahabe
COFAV	Manambidala	Manambidala	VOHILAVA MIARADIA	Alafady
COFAV	Manambidala	Vohilava	VOHILAVA MIARADIA	Ivarifoha
COFAV	Manambidala	Vohilava	VOHILAVA MIARADIA	Andemaky
COFAV	Manambidala	Vohilava	VOHILAVA MIARADIA	Amposa
COFAV	Manambidala	Vohilava	VOHILAVA MIARADIA	Iavatorao
COFAV	Ankarimbelo	Ambatombitro	ZAFINDRAHARAHA	Antoetra
COFAV	Ankarimbelo	Ambatombitro	ZAFINDRAHARAHA	Rejakely
COFAV	Ankarimbelo	Ambatombitro	ZAFINDRAHARAHA	Rejabe
COFAV	Ankarimbelo	Tsialamaha	ZAFINDRAMASY	Ambatomainty
COFAV	Ankarimbelo	Tsialamaha	ZAFINDRAMASY	Marofody
COFAV	Ankarimbelo	Tsialamaha	ZAFINDRAMASY	Ampasy
COFAV	Ankarimbelo	Tsialamaha	ZAFINDRAMASY	Kelivola

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