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Farmer Income Support Project (FISP) Coconut Farmers' Survey Report

Reprint of Report to Millennium Challenge Corporation
December 31, 2009, Revised March 14, 2010

By

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Farmer Income Support Project (FISP)
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December 31, 2009, Revised March 14, 2010

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EXECUTIVE SUMMARY

The Farmer Income Support project under the Millennium Challenge Compact for Mozambique is designed to reduce poverty and increase incomes in the coconut zones of Zambezia and Nampula Provinces. Coconut lethal-yellowing type disease (CLYD) has threatened livelihoods which rely on coconut trees to generate incomes and provide consumption goods. Burning diseased trees and planting new coconut varieties tolerant to the disease is only one part of the program, as farmers need to develop sources of income and consumption during the tree growth period, as well as more diversified income sources in the longer run.

The Ministry of Agriculture's Directorate of Economics and Michigan State University designed and implemented a household survey in the project areas. The survey combined households from the nationally representative rural household survey known as the Trabalho do Inquérito Agrícola (TIA) 2008 with additional households in the project area. By combining efforts with TIA, there were significant cost savings, and a total of 771 households were interviewed and retained in the database. Due to coordination issues, the survey was conducted in two distinct periods (late 2008 for TIA households and early 2009 for additional FISP households). The survey covered agricultural production information as well as information on off-farm income, demographics, and household assets.

The document details the sample selection methods which help to ensure that the households are representative of the population of coconut growing households, including households that have lost all coconut trees to disease. For purposes of sampling and design, a rapid appraisal was conducted with MCC, MCA, MINAG, and MSU in August 2008. With the delay in obtaining detailed aerial maps on coconuts and the disease, the Rapid Appraisal was useful to classify zones according to CLYD incidence at the time: 0% CLYD; 1>10% CLYD; 11-70% CLYD; and greater than 70% CLYD. For analytical purposes, the two lowest incidence zones were combined into a single 0-10% CLYD zone. The sample was not designed to be representative at a provincial level. In addition to CLYD level, we are able to analyze based on sex of the head of household, with 25% of households headed by women.

The key results of the survey concern incomes sources, existing cropping systems, differences between households depending on the sex of the household head, and differences between the CLYD zones. The majority of adults, especially among women, depend on agriculture as a main source of income. However, the higher the CLYD incidence, the more likely it is that the household does not rely on agricultural income. Both the average value of agricultural production and average total income are significantly lower in the highest CLYD zone compared to the two lower CLYD zones. Regarding household assets, the households in the highest CLYD zone tend to have lower asset levels. For example, 30% of households in the highest CLYD area have bicycles, compared to 53% in lowest CLYD areas. Overall households in the zones of highest CLYD incidence tend to be poorer, both in terms of income as well as assets.

Livestock ownership is confined to primarily chickens (65% of households), ducks (21% of households) and goats (14% of households) across the coconut zones. When calculating the number of tropical livestock units, we find that the average among livestock owners is only 0.24 (equivalent to 24 chickens or about 2 goats). Across all households, the average ownership is 0.16 units (equivalent to 16 chickens).

The farm sizes in the coconut zones ranged from a mean of 1 hectare in the 0-10% CLYD zone to 0.8 hectare in the >70% CLYD zone. Male-headed households tended to have larger overall land size, with 1.0 hectares compared to just 0.6 hectares for female-headed households. Of the 2071 farm plots that were evaluated, only 2% have any written document on land use rights, with many

households gaining use rights simply by occupying land or receiving from their parents or other relatives. Farmers had considered getting land use rights (DUAT) for only 12% of the plots. Those who failed to obtain indicated that they faced problems with a lack of funds or a lack of information on how to proceed.

There is little correlation between land area and number of coconuts trees suggesting that land may not be a limiting factor in expanding coconut production. Households average 29 coconut trees that they consider their own (with rights to the harvest), and that does not vary greatly by total land size groups. Farmers with more than 5 hectares of land average 32 trees whereas farms with less than 0.75 hectares average 25 trees.

On the farms, coconuts are usually not concentrated in a single field, plantation style, but rather are found in small areas of available land, including near the homestead, along the boundaries of crop plots, and along roadsides or paths. When coconut trees are grown in specific plots, they are most commonly intercropped with cassava and rice. A small percentage of farmers indicated planting groundnuts, cowpeas, bambara nuts, and sweet potatoes in the same plots with coconut trees, with the general tendency to intercrop up to three crops. Note that the intercropping may entail bands of crops along borders, rather than interspersed planting. Cassava and rice are the two crops grown by the majority of the farmers across the zones. Maize, sweet potatoes, and cowpeas are also important throughout the coconut region, with 30% or more of farmers cultivating. In the zones in which coconut had disappeared, analysts found cassava and cowpeas as the most common crops.

Among households that identified CLYD as a problem and had removed trees, the household had generally removed their own trees, rather than have a third party remove them. Further work is needed to understand if households are only willing to take out trees once they are no longer productive or in the earlier stages of the disease as productivity begins to drop. For FISP, it will be important to understand if tree removal is taken as a preventative measure to stop the spread of the disease, and if so, under what conditions.

This survey indicated a total of 5.5 million coconut trees under smallholder control in Zambezia and Nampula coconut zones. Coconuts contribute to the local economy in many ways. In this research, farmers were asked about various sources of revenues related to coconut production, including sales of fresh coconuts, beverages, and copra. The income from coconuts will be under-estimated here as there is also income from selling palm fronds for thatching, using coconut wood for artisanal goods as well as other uses that are included as part of income, just not specifically coconut-related income. Loss of coconut trees thus has a range of repercussions on the local economy. For farmers selling coconut products, farmers in the higher CLYD zone have average coconut income that is only 60% of the coconut income in the lowest CLYD zone. Across all farmers in the three zones, farmers in the higher CLYD zone had an average of 170 MTN per year from coconuts, compared to 655 MTN for the lowest CLYD zone, on average. The value of sales is higher when looking at just the households selling coconuts and although the metical amounts vary across the CLYD zones, coconut-related income is about 16% of average total income.

FISP interventions will involve the use of productivity-enhancing inputs and farmer information; this baseline study demonstrates that the initial levels are very low for fertilizers use, improved seeds, credit, and market information. An average of 5% of farmers use improved seed (from original packaging) and less than 1% used fertilizers. Use of technology may be related to very low rates of access to credit, with only 2.3% of the farmers using credit, primarily men. Only 7% of the farmers received extension advice during 2007/2008, whether from NGO or the public extension service. Only about one-third of farmers received market price information, most frequently via radio or friends and relatives.

The analysis and results indicate that this household survey could serve as a baseline for impact evaluation, but much will depend on the interventions selected and the implementation strategy and zones, decisions taken after the baseline survey was conducted.

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ACRONYMS

CLYD	Coconut Lethal Yellowing-type Diseases
DEFF	Design Effect
DEFT	Design Factor
DPA	Provincial Directorate of Agriculture
EA	Enumeration Area (sampling)
FISP	Farmer Income Support Project
GOM	Government of Mozambique
INE	*Instituto Nacional de Estatísticas* (National Statistics Institute)
MCC	Millennium Challenge Corporation
MCA	Millennium Challenge Account - Mozambique
MINAG	Ministry of Agriculture
MSU	Michigan State University
SME	Small and medium scale enterprises
TIA	*Trabalho do Inquérito Agrícola* (Rural Agricultural Household Survey)

1. INTRODUCTION AND BACKGROUND

In 2007, the Millennium Challenge Corporation (MCC) and the Government of Mozambique (GOM) established the Millennium Challenge Account (MCA), based upon the signed Compact. The Compact is designed to fund activities that will reduce poverty in Mozambique through economic growth, and increase economic opportunities for Mozambicans living in the northern region of the country. The overall program objective is "to increase the productive capacity of the population in selected districts in Northern Mozambique with the intended impact of reducing the poverty rate, increasing household income, and reducing chronic malnutrition in the targeted districts" (MCC/MCA Compact, 2007). There are four main components of the Compact, and this current work focuses on the Farmer Income Support Programme (FISP) designed to address critical aspects of farmer livelihoods in the coconut zones of Zambezia and Nampula Provinces (MCC/MCA Compact, 2007). These zones are threatened by coconut tree diseases and pests that are rapidly destroying productive trees in the zone. Farmers need a combination of efforts to avoid the elimination of coconut related incomes while developing new sources of agricultural income. As an independent institution, Michigan State University's Department of Agricultural, Food and Resource Economics has been contracted by MCC to implement impact evaluation[1] for the FISP as well as for the Land Tenure components of the Compact.

1.1. MCC/MCA FISP Project Focus

Coconuts have long been an important crop in Mozambique and the copra made from them is an important commodity for export. In 2007/8, for example, Mozambique was one of the world's top ten producers of copra, according to the Foreign Agricultural Service (FAS, 2010), producing 50,000 metric tons of copra that year. Coconut production is currently under threat from pests and diseases, especially Coconut Lethal Yellowing-type Diseases (CLYD). Areas of Zambezia and Nampula Province are currently affected by CLYD and the potential for rapid spread of the disease would mean that more than 50% of coconut production could be lost by 2015 (Eden Green 2006). Additional damage is caused by rhinoceros beetles, feeding off of the sick and dead trees, as well as newly planted seedlings (Eden-Green 2008). These threats to smallholder incomes and local industry have motivated the government of Mozambique with MCC to design a program of interventions for smallholders in the affected coconut production zones. Based on experience in Ghana and elsewhere, experts have proposed that all trees that are no longer productive be removed and destroyed, to be replaced with new varieties that are more resistant to the disease. Smallholders will need technical assistance to develop income sources to sustain them until new trees come into production in several years, and to supplement coconut incomes in the longer run.

1.2. Project Objectives and Activities

As indicated in the MCC/MCA Compact, there is a "five-component program of coconut disease control and rehabilitation measures combined with the introduction of new cropping value-chains that is designed to show a positive rate of return within an eight-year timescale" (MCC 2007). As designed, government, non-governmental organizations (NGOs), farmer and commercial estate sectors will work together towards mitigating the effects of CLYD and diversifying into new crop

[1] The impact evaluation component for FISP has been modified to focus on the survey during the initial period, with later evaluation as to whether it will be able to serve as a baseline. This will be discussed further in Chapter 8.

value chains. As planned, FISP will help 250,000 families[2] to stabilize their income, diversify their income sources, and improve their livelihoods in the coconut zones of Nampula and Zambezia Provinces (MCC/MCA Compact 2007).

Under FISP, smallholders will receive training in productivity enhancing technologies as well as in intercropping and alternative crops to attempt to ameliorate the impact of coconut disease and pests on agricultural income. Diversification of crop income and development of value chains for short term-crops such as beans, root crops, tubers, and fruits will be key objectives of FISP. In addition, with FISP, there will various actions designed to hinder the spread of CLYD and the potential devastation of coconut production in the zone (MCC/MCA Compact 2007). Under this program, both public and private sector should develop capacity to generate, adapt and apply plant protection measures. During the design and implementation of FISP and other MCC/MCA activities, there will be extensive work to include communities and small scale farmers in the process. A key aspect of the MCC/MCA Compact is the sensitivity to gender considerations, as will be discussed further when looking at analytical domains. A service provider has been selected for the FISP implementation and will be incorporating these aspects into their activities.

During the time of the Compact, the FISP service provider has two major objectives:

> (1) CLYD control and mitigation will provide the short-term control measures of surveillance, prompt eradication of diseased palms focused on tree cutting in the early years of the contract and replanting with the less susceptible Mozambican Green Tall coconut variety; and
>
> (2) Technical Advisory Services will introduce alternate crop-diversification options that demonstrate strong market demand and income generation potential, especially for farm enterprises participating in the CLYD control and mitigation program that are seeking short-term income alternatives during the period of coconut tree re-growth (MCC/MCA Compact 2007).

1.3. Outcomes and Outputs

According to the MCC/MCA Compact, there are two key components within FISP to be evaluated for which a household baseline is useful. First is the Farm Productivity Improvement component and second in the Business Development Fund. This baseline primarily serves to inform the farm productivity component. For this aspect, the FISP will focus on increased production and productivity improvement in selected crops as well as coconut. This includes planting new coconut trees, identifying and assisting farmers cultivate new crops, and improve production of existing crops, including coconut production.

With the FISP project, action areas were classified in the following way: 1) combined endemic and post-endemic zones; 2) epidemic zones (zones with increasing incidence of the disease); and 3) high risk zones (yet without incidence of the disease, but likely to experience CLYD in the near future). Post-endemic means that virtually all coconut trees have died. [3] Intercropping and diversification assistance will focus mainly on interventions in the post-endemic and endemic zone

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[2] These are MCC/MCA planned beneficiary numbers; actual beneficiaries will be confirmed with further analysis.

[3] It will be seen later, with the 2008 rapid appraisal, zones were classified on estimates of percentage of tress affected by CLYD. The post-endemic zones were combined with the parts of the endemic zones in which more than 70% of the trees are affected by CLYD. Another endemic zone was identified in which 11-70% of trees have been affected by CLYD.

where coconut trees have survived or will be replanted. For intercropping, the scope within mature stands of coconut is very different from that when replanting coconut.

As detailed in project documents, income generation will focus on crop diversification and intercropping with coconut trees, and soil fertility enhancements, either through nitrogen-fixing plants (such as legumes) or through application of nutrients for both coconut trees and other crops. The choice of diversification crops through FISP is oriented to crops with market demand. For this component, the expected outcomes are the following: "1) At least 80% of target farmers maintaining young coconut palms in good state of growth by end of year 3; and 2) at least 50% of participating smallholders are maintaining productivity improvements of the intercrops by end of year 3 and 60% by end of year 4" (MCC/MCA, 2007).

The Business Development Fund is designed to raise agricultural productivity through financial support via targeted grants to small and medium enterprises (SMEs). They will focus on those SMEs that serve a critical role in the value-chains of the coconut industry and intercrop products based on market analysis in the coconut belt.

1.4. FISP and baseline survey considerations

As indicated above, MSU was contracted by MCC to provide an independent analysis on the impact of the FISP.[4] To assess impact, it is necessary to establish a baseline of farmers, both those who are potential participants or beneficiaries of FISP as well as selected farmers who would be candidates but are in locations that will not receive the FISP program benefits. However, the original plan for a baseline survey and follow-up post-project impact evaluation (IE) survey have been modified due to several constraints. A key difficulty is that the selection of the implementing partner for the FISP Technical Advisory services was delayed, making it impossible to develop a baseline survey that was designed based on actual implementation plans. Second, the detailed CLYD maps expected to be available were not available at the time of sampling design, so there was a need to conduct a rapid appraisal to look at the incidence of CLYD. Sampling had to be based on the incidence determined through the rapid appraisal, given that different activities and investments would occur in different zones, as indicated above. A third consideration was the recognition that the FISP technical assistance component was not the most substantial investment under the Compact and thus would not necessarily warrant a large investment in IE, compared to other investments, thus resulting in a need to keep costs down. This third consideration was not the most important, but given the other challenges, it reinforced the idea of keeping the effort reduced and building on existing efforts.

In the end, the FISP survey approach was pragmatic and economical, using existing capacity and activities of the Ministry of Agriculture in Mozambique. To maintain comparability and make use of the extensive survey methods investment by MINAG, the FISP survey was based on the 2008 nationally representative rural household survey, *Trabalho do Inquérito Agrícola* (known as TIA 2008). There are two ways in which FISP linked with TIA 2008:

1) FISP coconut farmer used the survey instrument, enumerators, and survey systems designed for TIA 2008; and
2) FISP coconut farmer household dataset combines households from the TIA 2008 survey, as well as additional households interviewed under a special contract between MCA and MINAG to ensure sufficient sampling in the coconut regions.

[4] MSU has also been contracted to conduct impact evaluation (IE) of the Land Tenure projects of the Compact, a separate activity from the FISP IE.

The TIA 2008 survey instrument reflects several years of TIA efforts in Mozambique, with improved systems and reliability. The survey instrument was designed to collect information on agricultural production and marketing as well as nonfarm income sources, demographics and other household aspects related to food security. It was partially modified to suit FISP purposes.

Since TIA 2008 collected data in the coconut zones of Nampula and Zambezia Provinces as part of the representative survey, for the FISP baseline, selected households from TIA 2008 form part of the FISP sample. The challenge was to identify additional households to complement the TIA 2008 sample to have a sample that could represent the coconut farmers. FISP design was based on the classification of zones facing different levels of incidence of the disease, and so baseline indicators would need to be developed based on that classification. MSU collaborated with MCC/MCA in a rapid appraisal of the coconut zones to assess CLYD incidence (Eden-Green 2008) and to classify the zones. As will be detailed in the sampling section, the rapid reconnaissance activity enabled MCC/MCA to take advantage of coconut producing households already in the TIA 2008 survey sample and expand the sample in those coconut areas in Nampula and Zambezia not included in the TIA sample.

1.5. Structure of report

After the background information presented in Chapter 1, there are seven remaining chapters. Chapter 2 will describe in detail the survey activities including the sampling and field work. Chapter 3 follows with a presentation in the sample and description of the analytical domains. Chapter 4 presents to profile of coconut growing households in the coconut zones, including demographics, basic income sources and farm sizes. Next, Chapter 5 looks in greater depth at incomes source. Chapter 6 provides a look at the coconut sector more specifically, including disease patterns and actions taken. Chapter 7 looks at the other crops grown in the coconut zones, as well as access to information and use of different production technologies. The final chapter, Chapter 8, reviews aspects concerning the survey as a baseline exercise, including recommendations for further monitoring and evaluation.

2. BASELINE SURVEY DESIGN, SAMPLING, AND IMPLEMENTATION

2.1. Rapid Appraisal on CLYD incidence

As indicated in the short summary above, rapid appraisals were carried out in May 2008 in the main coconut growing districts of Inhassunge, Nicoadala, Namacurra, and Maganja da Costa to update information on the disease's advance and to select and classify regions for the baseline as well as for FISP activities. Eden-Green (2008) summarized the findings of these rapid appraisals:

- The disease has gotten much worse since the November 2006 situation analysis, both in extent and intensity but mainly the latter.
- There are strong indications that the development of disease symptoms is influenced by seasonal factors, with a lot of leaf yellowing symptoms appearing at the end of the main rainy season.
- In endemic zones, attacks by rhinoceros beetle are rampant and are damaging and killing off the remaining palms that have escaped CLYD.
- The main threat is to replacement coconut seedlings and younger plants which are favoured feeding sites of the beetles and are easily damaged or killed.

However:

- There are increasingly large areas where most coconuts have not only died but the dead trunks have already rotted away, and where beetle populations are likely to be much lower and damage less of a problem.
- The best strategy may be to concentrate rehabilitation efforts in these "post-endemic" areas where there will be little need for cutting and burning, with consequent saving in costs of tree removal and reduction in possible adverse environmental effects of burning.
- There is also likely to be greatest food insecurity, poverty and demand for project interventions in these areas.
- In contrast, control in epidemic and high risk areas will not be easy. Disease "fronts" are now very confused owing to the multiplicity and scattered nature of disease outbreaks.
- It will be necessary to maintain control at disease fronts even after infection levels increase above the proposed 10% threshold for selection, in order to maintain a phytosanitary barrier or "disease firebreak" behind the advancing disease front. The best strategy may be to concentrate on isolated disease foci (Eden-Green, 2008).

Based on the Rapid Appraisal, the coconut zones of Zambezia and Nampula Province were classified into four mutually exclusive categories: 1) coconut growing risk zones with 0% CLYD ; 2) epidemic zones with CLYD of 10% or less; 3) endemic zones with greater than 10% CLYD incidence but less than or equal to 70% incidence; and 4) endemic zones with greater than 70% CLYD as well as post-endemic areas with essentially no coconut trees surviving. The maps in Annex 1 indicate the classifications as determined during the rapid appraisal. Researchers modified maps from earlier work of the PASCOM project (Anon. 2001), based in the information from the 2008 rapid appraisal (Annex 2). Recent work has overlaid indicators for the survey enumeration areas with the TTI maps (see Annex 3) to understand the linkage between the survey areas and the zones as classified by TTI.

2.2. SAMPLING

2.2.1. Sampling for TIA

As detailed in Megill (2008), TIA 2008 sampling used two-stage stratification, based on a newly developed frame from the National Census of Population and Households completed in 2007. The TIA is designed to provide statistically reliable results at national and provincial levels. The sampling design also ensures that households from all 15 agroecological zones identified by the Mozambican Agricultural Research Institute are included in the sampling from the national frame.

The primary sampling units, or enumeration areas (EAs), are designed as geographical units with about 100 to 150 households. Almost 6,000 households were interviewed, including households in all 128 districts and limited urban zones. The stratification and clustering of this design necessitate using statistical methods to adjust the standard errors of estimates. In TIA 2008, 236 sample households in Nampula and Zambezia were found to have coconuts and could be included in the analysis for this FISP baseline study.

2.2.2. Sampling for FISP

The sampling strategy for the FISP project was based on the need for a stratified sample based on the estimated incidence of CLYD that would be representative of the coconut zones of Zambezia and Nampula Provinces. In Annex 4, Megill (2009) details the criteria used to develop the sampling to meet the FISP evaluation needs, and includes a summary on the sample frame and approach to weighting the resulting sample to generate population estimates for the indicators to be developed.

Using analysis based on previous TIA, an effective total sample size of 750 households was determined, across the TIA and FISP additional samples. As indicated above, there were 236 households that were sampled during the original TIA 2008[5] and then additional coconut-zone households sampled to increase the confidence in estimates specifically in the coconut zones. Given the analytical need to have estimates by CLYD zone, the selection of EAs was adjusted to include more EAs and households from the higher CLYD incidence areas than would have occurred with EA selection proportionate to population (see Table 1). While there are four categories developed during the FISP rapid appraisal and populations were sampled in each of these four categories, there are three analytical domains based on the Rapid Appraisal assessments of CLYD incidence in mid-2008: 0-10% CLYD, 11-70% CLYD, and greater than 70% CLYD.

Based on the adjusted sampling, the FISP additional households would total 545, to be added to the original TIA 2008 236 households from the coconut zones. Given the importance of understanding the dynamics of households in high incidence zone (71-100% CLYD), an additional EA was added to the sample, making 13 EAs. Megill, with assistance from Payongayong and additional information on National Census 2007, developed appropriate weighting for the complex survey sampling methods to obtain population estimates. For those purposes, each sample is considered to represent a proportion of the total sampling frame based on the proportion of the combined sample.

As detailed by Megill, the MCA/FISP survey sample consisted of 545 households, which is about 70% of the full sample. TIA households represent another 30% of the sample. The final weights were adjusted based on this distribution, such that the sample as a whole is considered to represent about 190,500 coconut producing households in Zambezia and Nampula Provinces (Megill 2009).

There were some delays in establishing the appropriate sampling weights both for TIA 2008 and for FISP. These delays stemmed primarily from difficulties with the National Census numbers and the relationship between EAs and their geographical location. Researchers were constrained in conducting analysis until final population numbers from the national census were released by the National Statistics Institute (INE) and the population weights for FISP were finalized early in December 2009.

Based on the complex sampling, with clustering and stratification, the standard errors of estimates will need to be adjusted, and confidence intervals developed using the revised standard errors. The design effects of the sampling are two-fold. Clustering of the sample (using the EAs) can result in standard errors that must be adjusted upward, for households within a cluster are more likely to be similar than households selected randomly. Stratification can help reduce the sample size efficiently, to be able to include several analytical domains that would need much higher sample sizes if randomly selected. Megill (2002) explains the statistical and computational issues and we use STATA (Stata 2008) to implement the adjustments, determining the Design Effect (DEFF) and its square root, the Design Factor (DEFT). When the DEFT is above 2.0, it means that the sampling resulted in standard errors that are roughly twice what they would be under simple random sampling, i.e. the clustering and other design effects are fairly significant. In that case, there is a loss in precision of the estimates and confidence intervals will be wider than if the sample had been a simple random sample.[6]

[5] Megill 2008 details the overall TIA 2008 sampling strategy, which was based upon preliminary numbers from the 2007 Population Census.

[6] For the sake of brevity, DEFF and DEFT will not be presented in this report for all components; however, they can and have been estimated. The adjusted standard errors are also used in all hypotheses testing of differences.

Table 1 Distribution of Sample Enumeration Areas (EAs) and Sample Households with Completed Interviews for FISP Coconut Producers Survey, with MCA/FISP and TIA 2008 surveys, by CLYD Stratum and Province

Survey	CLYD zone			
	0-10%	11-70%	>70%	Overall
MCA/FISP				
Nampula				
Sample Eas	8	1	3	12
Sample HHs	120	15	35	170
Zambezia	0			
Sample Eas	8	7	10	25
Sample HHs	120	105	150	375
Total MCA/FISP	0			
Sample Eas	16	8	13	37
Sample HHs	240	120	185	545
TIA 2008	0			
Sample Eas	20	11	2	33
Sample HHs	154	70	12	236
	0			
Overall FISP survey	0			
Sample Eas	36	19	15	70
Sample HHs interviewed	394	190	197	781
Sample HHS retained	386	190	194	771

Source: Adapted from Megill 2009.

Notes: CLYD is coconut lethal yellowing –type disease and stratum indicates approximate incidence of the disease assessed during 2008 rapid appraisal; EA are enumeration areas. Eleven FISP households with completed interviews were excluded for being out of scope (no coconuts, recent past or present), leaving an effective sample of 771 households. "hhs" indicates households.

2.3. Baseline Survey[7]

As indicated earlier, the baseline survey was conducted in two separate exercises. In late 2008, 256 households were interviewed within the TIA 2008 survey. As indicated in the sampling section above, additional households were surveyed by the Ministry of Agriculture in collaboration with MCA – Mozambique between March 31st and May 7th, 2009 in Nampula and Zambezia Provinces. That process was documented by Miguel and Achicala (2009)[8]. We will refer to the later survey as

[7] The use of the term "Baseline Survey" may not be the most appropriate here. A key factor is that the specific interventions in the FISP zones had not been determined at the time of the survey, and the survey used an existing survey effort to capture the information. If the FISP service provider decides on interventions that are not already captured in the survey, there will be no baseline measurement for those interventions.

[8] The section on survey sampling relies heavily on Miguel and Achicala (2009) for documentation on survey implementation for the FISP additional survey. That report is found in Annex 5. For TIA 2008, see Megill 2008.

the MCA/FISP survey, whereas the full FISP coconut survey dataset includes both the TIA 2008 coconut farmers as well as the MCA/FISP coconut farmers.[9]

The delay between the TIA 2008 and the MCA/FISP data collection is not expected to cause bias in the results. The area for greatest concern is coconut products, because there was a harvest period between the two data collection periods. The bias would occur if recall periods were not the same for each or if farmers reported production and sales for the most recent harvest for the MCA/FISP, rather than the earlier harvest which is the recall for the TIA 2008 survey. We will be evaluating for such difficulties in the coming sections.

2.3.1. TIA 2008 survey

The survey instrument for TIA 2008 was developed by MINAG. Based on MSU collaboration with MINAG, it was adapted to some extent to capture more of the information needed for the FISP baseline survey on the coconuts zones. Unfortunately, the agreement between MCA and MINAG on data collection was not signed until after the TIA survey began implementation, so there were no financial resources available at the time to add extensive additional coconut questions that could have been valuable but would have required additional interview time. On the positive side, the TIA 2008 survey interviewed 236 households in the coconut zones, obtaining extensive information at no cost to MCA or MCC.

The survey instrument, found in Annex 6 and Annex 7, encompasses a range of information including livestock production, farm size, crop production, CLYD incidence, as well as the land tenure. The reference period for production is the cropping season 2007/2008. As with most surveys, there were three main phases: a) survey design, b) training, and c) data collection. In this case, there were two survey implementation periods, the first with the MINAG TIA 2008 survey implementation and the second with the MCA FISP additional survey. Since MCA funding was provided for the MCA/FISP additional households, the MCA/FISP survey will be documented more thoroughly below.

2.3.2. TIA Survey design

The TIA survey instrument has evolved over time, from the early efforts at rural household surveys in 1991 through the present TIA 2008. With each TIA exercise, the questionnaire is revisited with an eye to priorities and activities of the government of Mozambique, to ensure that it can be responsive to information needs. With each change in the instrument, extensive pre-testing is conducted by MINAG staff with MSU, in coordination with the Provincial Directorates of Agriculture (DPA). The preparation of training materials and field visits is carried out by MINAG with technical assistance of MSU.

Over time, extensive efforts have gone into aspects related to measurement of land areas, harvest estimation for roots and tubers, especially cassava, and systems for estimating income from farm and non-farm activities. For the CLYD work, a laminated sheet with color photographs was developed to ensure identification of CLYD and beetles (Annex 7). These developments have resulted in the TIA becoming a standard for rural household surveys in Mozambique. The guides for field operations, data entry and logistics ensure that quality control occurs all along the way (eg. MINAG 2008). CSPro (CSPRO 2008) is the software used for data entry and TIA 2008 data entry was conducted in the field.[10]

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[9] Analysis in the document will use the full FISP coconut farmer survey database, unless otherwise indicated.

[10] For more information on the TIA systems, see Kiregyera, Megill, Eding and Jose 2007.

2.3.3. Field work for MCA/FISP additional sample

In March 2009, with funding from MCA, MINAG staff from the Directorate of Economics trained 22 enumerator candidates selected from Nampula and Zambezia Provinces (Annex 5). The training of enumerators consisted primarily in the incorporation of questions on access to land and additional pertinent questions on coconut to the standard questionnaire used for TIA 2008 (Miguel and Achicala, 2009). All of the trainees had been involved previously in the TIA surveys and were experienced enumerators. There were 9 candidates for Nampula and 13 candidates for Zambezia. The Provincial Directorate of Agriculture was involved with the logistics and also provided technical assistance, with its coconut specialist and staff from the Department of Economics. Both MSU and MCA-Mozambique had staff present at the training.

2.3.4. Data collection for MCA/FISP

Using systems developed by MINAG for the TIA, data collection in Zambezia and Nampula was performed by five teams (*brigadas*), each comprising one supervisor (head of the brigade), three enumerators, and one driver. These teams covered the five districts in Zambezia and 2 districts in Nampula Province. Based on the survey sampling design detailed above, 15 households were selected randomly from a household listing in each of the selected enumeration areas (EA)s. There were 37 EA selected for this sample, to complement the existing TIA 2008 households. In Zambezia province, the following districts in coconut producing areas were selected: Nicoadala (5 EAs), Namacurra (5 EAs), Maganja da Costa (7 EAs), Inhassunge (6 EAs) and Chinde (2 EAs). In Nampula province, Moma (4 EAs) and Angoche (7 EAs) were selected.

During the implementation of the survey, the research team observed some difficulties (Miguel and Achicala 2009). The main difficulties encountered during the fieldwork were the following: 1) household refusals to be listed for interviews in the district of Namacurra in the administrative post of Macuse (EA Mulevala and Manong), but once households were listed, none refused to participate in the interviews; 2) household refusals to be interviewed in Angoche District, EA 26, Napruma[11], so another village was substituted; 3) not all land area measurement could be completed, especially for plots of rice that were reported flooded, plots found on islands without access, and plots found to be inaccessible by road or other means; and some selected EAs in which no coconut trees were found.[12]

With TIA 2008, data entry was conducted in the field, enabling faster verification and easier access to information for corrections to surveys. Due to logistical constraints, the data entry for the MCA/FISP survey was not conducted in the field, but rather in Maputo. This created some delays and made it more difficult to deal with possible errors, but the MINAG data entry staff were experienced with data entry and so were able to recognize and correct some errors based on previous experience.

[11] In this village and on several other occasions, inhabitants mistakenly associated enumerators as people who would contaminate their village with cholera and so refused to work with them. See Miguel and Achicala 2009 in Annex 5 for greater detail.

[12] See Miguel and Achicala 2009 for greater detail.

3. Baseline Data of Sample Villages

3.1. Sample and Population Statistics

The FISP sampling was designed to represent approximately 191,000 coconut-growing households in the coconut regions of Zambezia and Nampula Province, out of a total of 1.5 million rural households in those two provinces. There were 781 completed household interviews, for an interview rate of 0.4%, and these households will be used in the tables to be created.[13] In some cases, households did not currently have coconuts but did have coconuts in earlier years and had lost them due to pests and disease. Such households were retained in the sample. The sample was not designed with province as an analytical domain, so we will not be analyzing the data based on that administrative division. Analysis was conducted in STATA 10.1 (StataCorpLP, 2009), using complex survey weighting to adjust for the clustering and stratification of the sample.

After the survey implementation, analysis determined that 11 households should be considered out of this sample of coconut farmers, for they did not have any coconuts and they did not indicate having had coconuts in the past. Sampling weights were adjusted to incorporate this exclusion and the resulting population numbers for each CLYD zone, by province are in Table 1. The survey is considered to represent about 191,000 households in the coconut regions of Nampula and Zambezia.

3.2. Analytical domains: CLYD zone and sex of household head for coconut farmers

Given the objectives of FISP, the sample should allow for disaggregation by CLYD classification and for disaggregation by the sex of the household head and by coconut production. It was not possible to use all three criteria to design the sampling for FISP without a much larger and costly sample size. Instead, the sample selection was stratified by four CLYD zones, the key criterion based on FISP workplans and objectives. These zones were converted to three analytical CLYD zones, in collaboration with MCC and MCA staff. While the sample was not stratified by sex of the household head, in rural Mozambique, female-headed households make up about 25% of all households and so a random sample of sufficient size will capture enough of female headed households for analytical purposes. It was not possible to stratify by coconut production, due to the difficulties of designing efficient listing instruments to capture coconut production data.

As detailed in Megill (2009), the variability of these key aspects was assessed using TIA 2007 data and then the sample design developed. Table 1 indicates the distribution of the FISP coconut survey based on those analytical requirements. Testing indicates that there is no significant difference between the CLYD zones for percentage of female headed households, so they are well distributed with the existing sample, as anticipated.

4. SOCIO-ECONOMIC PROFILE[14]

A preliminary examination of the coconut producing households in the project area can be found below. Key characteristics include demographics of the family, education, assets, and total income.

[13] Some tables only involve a subset of households and that will be clearly indicated in the table.

[14] Annex 8 provides basic output tables for the FISP Coconut Farmers Survey, complementing what can be found in the text here.

It is anticipated that the zones most affected by CLYD would reflect lower income and asset levels, due to losses in income with CLYD.

4.1. Introduction

Table 2 presents a few key characteristics of the coconut farming households in the FISP action zones. As was expected, about 25% of households in the coconut growing region are headed by women. Looking at the total adult population, there are 53 women out of every 100 people.

Among the household heads, 43% had no formal schooling, and there were no significant differences between the CLYD zones (Table 2). Looking across all household members age 10 years or greater, 42% were said to be able to read and write. Additional analysis shows that three or fewer years of schooling is strongly associated with lack of literacy in these households.

4.2. Family size and occupation

The average household in the coconut zones has 4.7 people (Table 2). A typical household might have one infant, two young children, and two adults. While the average numbers vary between the regions, we found no significant differences in the means among the CLYD zones.

Across the coconut zone, a minority of producing households is involved in salaried jobs or self-employment (outside own agricultural production) (Table 3). Agriculture is the principal activity for a majority of people over 10 years of age, but there are substantial numbers of households who either do not practice agriculture or who only have agriculture as a secondary activity. Women are significantly more likely to declare agriculture as their primary activity, with 83% declaring so, and significantly fewer women indicated self-employment or salaried income. Additional analysis shows that among women household heads, fully 95% have agriculture as their main source of income.

4.3. Non-land family assets

In the coconut producing households, the most common household assets are gas lantern, radio and bicycle. Land will be discussed in greater detail in a later section. The survey asked questions on both productive assets related to agriculture and then household assets such as tables and radios. Table 4 presents the results. Various assets have not been included in the table due to the extremely low number of households owning them (less than 1%). Falling into this category are cereal mills, motorcycles, trucks, cars, refrigerators and water pumps. The majority of households did have machetes and hoes. About 52% of households had axes, and another 71% had machetes. Female-headed households were also significantly less likely to have axes and machetes than male-headed households.

For the household assets and quality of housing, the majority of families have straw or thatched roofs, with only 11% having zinc or other quality roof. Only 7% of female headed households had improved roofs of zinc or other material and that was significantly lower than the 13% of male-headed households. Improved quality roofs were distributed across the different CLYD zones.

Table 2 Selected characteristics of coconut growing households, by CLYD zone

Characteristic	CLYD Zone A 0-10%	B 11-70%	C >70%	Overall	Testing[1]
Household headed by women (%)	24%	27%	31%	25%	
Age of household head (years)	43	42	46	43	* C > A&B
Education of Head					
No formal schooling (%)	40%	42%	45%	41%	
1-3 years of schooling (%)	20%	17%	26%	19%	
4-6 years of schooling (%)	30%	27%	20%	29%	
More than 6 years of schooling (%)	10%	15%	8%	11%	
Literacy (% persons over 10 years of age)	46%	42%	42%	45%	
Household composition: Average number of members per age group					
Infant (<5 years)	0.8	0.7	0.8	0.8	
Child (5-<15 years)	1.6	1.4	1.6	1.5	
Adult (>=15 years)	2.4	2.2	2.8	2.4	
Total number of members	4.8	4.4	5.2	4.7	
Women, as a percentage of all adults, 15 years of age or older	57%	55%	54%	56%	

1 Significance testing: * indicates significant difference at 10* level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Table 3 Sources of income: Percentage of household members with different sources, by CLYD zone

Characteristic	CLYD zone A 0-10%	B 11-70%	C >70%	Overall	Women	Men
Adults salaried employment	13%	10%	12%	12%	5%	20%
Adults with self-employment income	21%	24%	17%	21%	5%	40%
Adults with agriculture as main source of income	71%	69%	67%	67%	83%	55%
Adults with agriculture as a second source of income	23%	23%	21%	22%	14%	33%
Adults with no agricultural income	6%	8%	12%	7%	2%	12%

Note: Adults are all persons age 15 and older.
Testing results: For non-ag income, C>A at 5% level. Otherwise for CLYD zones, no significant differences.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Table 4 Percentage of households owning various assets, by CLYD zone

Asset	CLYD zone 0-10%	11-70%	>70%	Overall	Testing
Sickle	15%	7%	4%	12%	
Machete	73%	70%	60%	71%	
Ax	56%	48%	45%	52%	
Household assets					
Kerosene Lantern	61%	60%	62%	61%	
Radio	47%	44%	40%	46%	
Bicycle	53%	45%	30%	49%	** A > C
Latrine	18%	15%	16%	17%	
Table	44%	44%	47%	44%	
Improved roof	15%	12%	11%	14%	
Improved cereal storage	3%	7%	8%	4%	

Note: Improved roof includes zinc, lusalite, tiles, or metal sheets.
Testing: ** indicates significant at 5% level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

4.4. Livestock assets

Livestock ownership often helps to indicate the wealth of a household, but can also be important in terms of income earning potential. Here we look at the stock of livestock assets and in Chapter 5, we will discuss the income aspects. Chickens and ducks are widely spread throughout the four CLYD zones (Table 5). Few households have cattle or cows, and those households are mainly in the 0% CLYD zones. For the most affected CLYD zones, sheep, cattle and pigs are virtually non-existent among these coconut farmers.

To be able to view total livestock ownership across the different types, FAO (2009) has developed standards to convert animals into a "tropical livestock unit" (TLU). When examining the households that own these different animals and poultry, it can be seen that the average household ownership is low. As can be seen in Table 6, there is variability across the different CLYD zones, and the 11-70% CLYD zone has significantly lower TLU per household than the other zones.

4.5. Farm size

Land area measurement is one of the most difficult things to accomplish in Mozambique and farmers often do not have an accurate sense of land area in terms of hectares. In this work, 25% of the households have plots measured by the enumerators to get a sense of land area and for the rest, farmer estimates are used, with some adjustments based on comparison between stated area and measured area (see Mather, Cunguara and Boughton, 2008 for more details.)

Table 5 Percentage of farmers owning each type of livestock

Livestock	CLYD zone				Testing
	0-10%	11-70%	>70%	Overall	
	(% of farmers owning)				
Cattle/cows	23%	0%	1%	2%	
Goats	15%	9%	20%	14%	* B<C
Sheep	6%	0%	0%	4%	** A>B
Pigs	1%	0%	0%	1%	
Chickens	63%	63%	69%	64%	
Rabbits	0%	0%	1%	0%	
Ducks	22%	17%	18%	21%	
Guinea Fowl	1%	1%	1%	1%	

Notes: Testing: * indicates significant at 10% level; ** significant at 5% level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

Table 6 Average number of livestock owned, by type of livestock and CLYD zone, only for farmers owning that livestock

Livestock	CLYD zone			
	0-10%	11-70%	>70%	Overall
	(mean number owned among farmers owning)			
Cattle/cows	5.5	-	5.9	5.5
Goats	4.3	5.0	5.3	4.6
Sheep	3.6	-*	-	3.9
Pigs	6.5	-	-	6.5
Chickens	6.4	6.1	6.9	6.3
Rabbits	-	-	2.0	2.0
Ducks	5.4	4.6	4.3	5.2
Guinea Fowl	6.7	3.4	5.2	5.9
Tropical Livestock units (TLU)				
All farmers	0.19	0.07	0.14	0.16
Livestock owners	0.29	0.11	0.20	0.24

Note: * Only one household had sheep in CLYD zone 11-70%.
TLU are estimated using FAO conversion units: cattle=0.5; pigs=0.2; sheep & goats=0.1; poultry=0.01; and rabbits=0.02.
Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

There is a particular challenge with these data as related to coconuts. The word in Portuguese *machamba* generally refers to a cultivated plot and farmers view it as those plots with annual crops (intercropped with trees or not). Enumerators are trained to ensure that orchards and plantation-style plots with trees are included as *machambas* but there is a possibility of under-counting for such plots. In addition, the estimation of cultivated area excludes the homestead area (where the house is located), a logical exclusion. Since coconuts are often found scattered around the homestead land[15], it also means an underestimate of cultivated land and land planted to coconuts. Another complication on land area to coconuts was observed during the rapid appraisal (Payongayong 2008). Coconuts may be found on land to which the farmer does not have cultivation rights and coconuts may be scattered, alongside irrigated plots of rice or elsewhere. While the trees are counted, the land area is not estimated. These aspects will become critically important when we look at intercropping and coconuts.

As found by Walker et al (2004), farmers in Mozambique on average cultivate 1.5 ha, and rarely exceed 2 hectares and we find similarly small land areas in this study in Zambezia and Nampula coconut zones (Table 7). For land ownership, we also looked at male and female-headed households.[16] Female-headed households have lower average landholdings and cultivated areas than male-headed households.

Table 7 Total farm size and cultivated area, by CLYD Zone and gender of household head

							Mean area by gender of head	
	CLYD Zone	Median	Mean	Std. Err.	[95% Conf. Interval]		Male	Female
		(hectares)			(hectares)		(hectares)	
Total farm size	0-10%	0.6	1.0	0.11	0.81	1.26	1.2	0.6
	11%-70%	0.5	0.7	0.10	0.53	0.94	0.8	0.6
	>70%	0.6	0.8	0.10	0.60	0.98	0.9	0.6
	Overall	0.6	0.9	0.08	0.77	1.10	1.0	0.6
Cultivated area	0-10%	0.6	1.0	0.10	0.75	1.16	1.1	0.6
	10%-70%	0.5	0.7	0.11	0.44	0.88	0.7	0.5
	>70%	0.6	0.7	0.08	0.55	0.88	0.8	0.5
	Overall	0.5	0.9	0.08	0.71	1.01	1.0	0.6

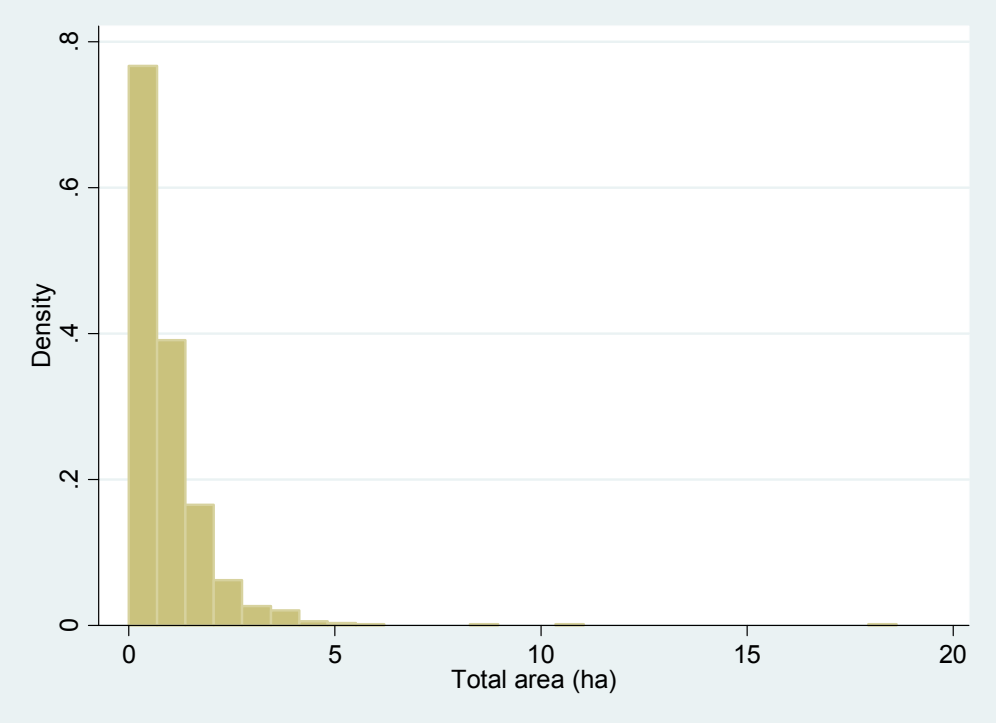
Testing: Significant differences found between male and female headed household for total land area and cultivated land area. For these variables, the 0-10% CLYD zone was significantly higher than the 11-70% CLYD zone, at the 5% level.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

[15] See Payongayong 2008, found in Annex 3 to this document.

[16] In this baseline report, we focus on CLYD zonal issues. Clearly there is substantial work that can be done in the future with analysis by gender of household head.

Figure 1 demonstrates graphically what the numbers in the table tell us: the vast majority of Mozambican smallholders have very little land, less than 2 hectares per household. This has implications for agriculturally based strategies to reduce poverty.

Figure 1 Farm size distribution, in hectares



Source: FISP Coconut Farmer Survey, 2008/9.

Table 8 Average number of trees per household, by land size category

Farm size	Average number of coconut trees per household
less than 0.75ha	25
0.75-1.745 ha	31
1.75-5.00 ha	34
More than 5.00	32
Total	**29**

Source: FISP Coconut Farmer Survey, 2008/9.
Estimates weighted to reflect population.

While we cannot estimate land area specifically in coconuts, we did look at the average number of trees per household, based on total land estimates for the household (Table 8). It is surprising that the average number of tress remains fairly constant, regardless of the total land area available to the farmer. We will examine coconut tree stocks in more detail later in this report.

4.6. Land ownership and titling[17]

The household head was asked if anyone in the household was familiar with the Land Law, and only 16% of heads indicated that at least one person in the household was familiar with the law. For female-headed households, only 5% responded positively, a significantly lower percentage than for male-headed households. When comparing the responses for the CLYD zones, the highest incidence zone had significantly fewer households with knowledge of the land law, compared to the other zones (Table 9).

Various questions were asked at a plot level within each household to assess the sense of security of land tenure for that plot. Only one household in the sample had a plot with a title. About 2% of the plots had other documents to demonstrate the households' land use rights, of which one half were in the 0% CLYD zone. Table 9 indicates the source of the land use rights, at a plot level for the 2071 plots in the sample. As can be seen, occupying land, obtaining through parents, and inheriting it from parents after their deaths are the most important ways to obtain use rights, regardless of gender of the heads or CLYD zone.

When asked further about whether the household had ever thought of getting a title for the plot, the households had considered getting the land title for 12% of the plots (Table 10). Among female-headed households, only for 5% of plots had titling been considered. For households who had thought of getting a title, the most frequent response for failing to do so was the lack of information on how to arrange it and the second most common response was lack of money. Female-headed households were more likely to mention their lack of knowledge on where to get a title than male-headed households.

There were conflicts over land tenure for 4% of the plots (Table 11). About 56% of these conflicts were concerning the errors in the ownership boundaries or in demarcation of the plot, although a few plots had inheritance issues, sales to more than one person, lack of proper community input and other reasons. Neighbors were the main source of conflict in 57% of land conflicts; private firms were the source of conflict in 17%, while relatives were involved in 8% of conflicts. There were no significant differences between the zones for presence of a conflict.

While we do not present the data in Table 11, household heads indicated the potential for future tenure conflicts for about 4% of the plots, and the two most cited agents with whom conflicts were anticipated were neighbors and private firms. There are no significant differences between the CLYD zones on these responses, and looking at sex of the household head, there are no significant differences.[18]

[17] Several land questions concerning the Land Law were asked in an additional Survey Annex sheet (see last page of Annex 6). The Annex was prepared in time to include in the MCA/FISP survey, but revisits to households have been required for the TIA 2008 households. Data for the TIA 2008 households will only be available later in 2010.

[18] There are only 31 plots for which women-headed households indicated concerns about future conflicts, thus limiting our ability to make inferences.

Table 9 Source of land use rights

Source of Tenure	CLYD zone 0-10%	11-70%	>70%	Overall	Male headed hhs	Female headed hhs
			% of households			
Authorized by traditional leaders	2%	2%	0%	2%	2%	2%
Authorized by Government authorities	2%	4%	5%	3%	2%	5%
Given by parents	23%	24%	18%	23%	22%	25%
Rented	1%	1%	1%	2%	2%	0%
Loaned	9%	2%	4%	7%	7%	5%
Occupied land	25%	27%	28%	26%	25%	27%
Purchased	13%	11%	11%	12%	13%	9%
Inherited	25%	25%	34%	26%	25%	27%
Others	1%	-	0%	0%	1%	0%

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Table 10 Land law and titling issues, by CLYD zone and sex of head

Land aspect	CLYD zone 0-10%	11-70%	>70%	Overall	Testing CLYD zones	Male headed hhs	Female headed hhs
				% of households			
Someone familiar with land law	20%	14%	10%	17%		19%	5%
				% of plots			
Have some document indicating use rights	na	na	na	2%		2%	2%
Considered getting a title	15%	8%	9%	12%	** A>B	15%	5%
If considered, why not get a title?							
Not know how	44%	9%	74%	41%	** B<A,C	41%	38%
Not know where	15%	38%	9%	18%	** B>A,C	14%	62%
No money	34%	22%	7%	30%	** A>C; *B>C	33%	0%
Do not need it	3%	23%	0%	6%		7%	0%
Other	4%	7%	9%	5%		5%	0%

Note: Total of 2074 plots evaluated. "na" indicates not applicable, too few cases to evaluate.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Table 11 Percentage of plots for which there was conflict, reasons and sources of conflict, by sex of household head

Land aspect	Overall	Male headed hhs	Female headed hhs
		% of plots	
Someone had a conflict over plot	4%	4%	4%
If conflict, with whom?			
Traditional authorities	1%	1%	0%
Formal authorities	1%	1%	0%
Family members	8%	6%	14%
Neighbors	57%	56%	60%
Firms	17%	19%	6%
Others	17%	17%	20%
If conflict, over what?			
Boundaries	49%	47%	56%
Inheritance problems	10%	9%	14%
Deficient land demarcations	7%	9%	0%
Sales to more than 1 person	2%	2%	0%
Community leaders not properly consulted	2%	2%	1%
Other reasons	31%	31%	29%

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

5. HOUSEHOLD INCOME

Households earn income from a range of sources and in a dynamic rural economy there are strong linkages between agricultural and non-agricultural incomes and income growth. The income estimates for the cropping year 2007/2008 are presented in Table 12, with additional details in Table 25 (income coconuts) and Table 28 (income from more specific crop categories). For this work, a full income approach is used. This includes valuing all crop production whether for sales or home consumption. Cash inputs, such as hired labor and purchased seeds and fertilizers are deducted from crop production. For more information on TIA income estimates, see Mather et al (2008).

5.1. Gross revenue for agricultural commodities and livestock

Based on reported crop production and declared prices for agricultural commodities, the average and median value of production can be estimated. As seen in Table 12, the zones most affected by CLYD have significantly lower crop income. With this cross-sectional data, we are unable to attribute causality for lowered incomes to CLYD, although it seems a logical conclusion.

Only 24% of the households have sold livestock or livestock subproducts (eggs, milk, etc.), and the highest values are in the 0-10% CLYD zones. In Table 12, values are reported across all households (including 0 values) and then just for households with some sales to get a sense of how important such sales could be for those participating in the activity.

5.2. Non-agricultural income

There are various sources of non-agricultural income which can be estimated for these rural households. Here, the following sources are combined: 1) salaries and wages; 2) income from non-

farm self-employment activities; 3) retirement, remittances and other transfers; and 4) rental of land or other assets. For the TIA and hence for this work as well, there are challenges in estimating the net income from non-farm activities, especially from self-employment activities. For example, large investments (such as machinery) may all be attributed to a single year or inputs may be spread across outputs that are not yet sold.

5.3. Total family income

Using the full income approach (valuing all production, regardless of whether consumed in the home or marketed), the average across the coconut farmers is about 2542 meticais per capita annually in current values (US$85 using 30 MTN per dollar) (Table 12). As is expected, the distribution is skewed, and the median value is lower, at 1572 meticais per capita annually.[19] The highest CLYD zone has average income that is significantly lower than the 0-10% CLYD zone and the 11-70% CLYD zone. Figure 2 shows the distribution of the total incomes for each CLYD zones. The distribution for the highest CLYD zone is clearly more skewed to the left, the lower income levels, compared to the other two CLYD zones.

5.3.1. Total family income, comparing MCA/FISP households to TIA 2008 in the sample

Since there were six months between the data collection for TIA 2008 and for MCA/FISP, we examined total income estimates to see if there were significant differences between the two samples. For total income and income per capita, there are no significant differences overall. As mentioned earlier, a key aspect in this baseline analysis is whether the coconut income shows signs of bias due to the timing of surveys and that will be evaluated in Chapter 6.

[19] Researchers are still evaluating the prices chosen for valuation as well as others aspects with income, thus of interest is the relative values, rather than the absolute levels of the income estimates.

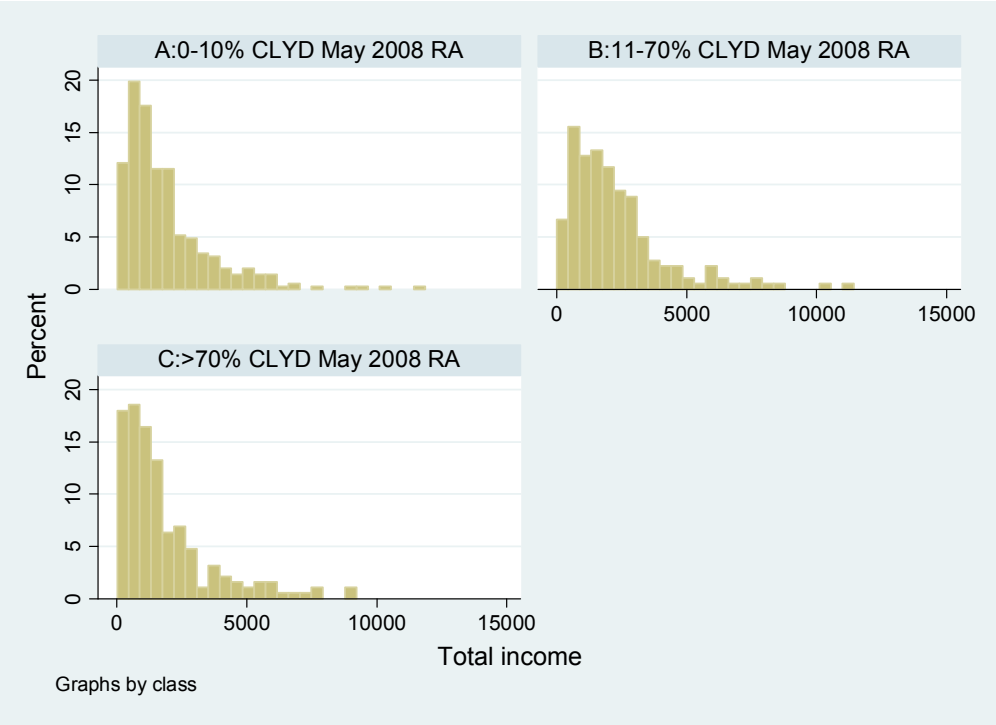
Table 12 Household income for cropping year 2007/2008 (in meticais), by CLYD zone

Income	Measure	CLYD zone				
		0-10%	11-70%	>70%	Overall	Testing
		(value in Meticais)				
Total value of agricultural production						
For all HHs	Mean	7955	6682	4311	7349	** A, B >C
	Median	4727	4538	2839	4491	
Total value of livestock and sub-product sales						
For all HHs	Mean	471	84	148	348	
	Median	0	0	0	0	
For HHs w/livestock sales	Mean	1864	397	704	1455	
	Median	225	150	200	200	
Total nonfarm income						
For all HHS [1]	Mean	6467	5810	4714	6163	
	Median	1080	1200	1000	1090	
For HHs with nonfarm income	Mean	9876	8810	6949	9368	
	Median	3510	3534	3000	3510	
Total Income [1]						
For all HHs	Mean	11542	10613	7965	11026	** A, B > C
	Median	6691	7149	5034	6734	
Total Income per capita [1]						
For all HHS	Mean	2591	2614	1886	2542	** A, B > C
	Median	1512	1887	1278	1572	

[1] One household with nonfarm income of 251,000 MTN was excluded as it was highly influential and clearly not common.
Estimates for all households unless indicated otherwise. HHS means households.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

Figure 2 Distribution of Income per capita, by CLYD zone



Source: FISP Coconut Farmer Survey, 2008/9.

6. CHARACTERISTICS OF COCONUT TREES AND COCONUT ECONOMY

6.1. Household coconut tree stocks

Each household was asked about their coconut trees. Smallholder "ownership" of a tree may come about in various ways in rural Mozambique. Trees may be in farmers' fields, where the farmer has a title or other form of use right (legal or customary). Trees may also be along the roads or paths or near the homestead, or a farmer may have planted the tree in public space, such that customary use is identified with a particular family or person and thus part of the household stock of trees. Using the baseline survey data, total tree stocks among the smallholders are estimated to be 5.5 million trees in the study zone, although the variability in the sample is high, especially in the 0-10% CLYD zone, as seen in the confidence interval estimates in Table 13. This is also true with the declared smallholder productive stock at about 4.24 million trees, so analysis on these stocks should take into account the distribution of values.

For households who had coconut trees at the time of the interview, the average number of trees across all regions was 24, ranging from an average of 21 in the highest CLYD zone to 42 trees in the zone with 11-70% CLYD (Table 14). The lowest average number of trees was in the highest CLYD zone, as might be expected, but was only slightly lower than for the lowest CLYD zone. Since the distributions are skewed, the median might be more appropriate to examine and use in economic evaluations: overall median of 12 trees ranging from 9 in the highest CLYD zone to 20 in the zone with 11-70% CLYD.

Table 13 Coconut trees: estimated stock and productive stock of trees

	Estimated total stock of coconut trees (000s of trees)					
CLYD zone	Total Trees	S.E.	95% Confidence interval		DEFF	DEFT
0-10%	3, 250	931	1,396	5,100	10.9	3.3
11-70%	1,995	536	927	3,064	1.6	1.3
>70%	228	54	120	335	0.5	0.7
Total	5,473	1,075	3,331	7,615	4.8	2.2

	Estimated stock of productive coconut trees, 2007/2008					
CLYD zone	Total Trees	S.E.	95% Confidence interval		DEFF	DEFT
0-10%	2,592	795	1009	4175	9.7	3.1
11-70%	1,546	475	600	2,493	1.5	1.2
>70%	104	27	51	158	0.3	0.6
Total	4,243	926	2,398	6,088	4.2	2.1

Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

Table 14 Coconut trees per household for households with coconut trees, by CLYD zone

	Number of coconut trees owned by household [1]						
CLYD zone	**Median**	**Mean**	S.E. Mean	95% Confidence interval		DEFF	DEFT
0-10%	10	25	4.4	17.2	33.7	3.8	2.0
11-70%	20	42	11.1	19.9	64.2	1.7	1.3
>70%	9	21	5.0	10.9	30.8	0.6	0.8
Total	12	24	3.8	21.8	37.0	2.1	1.5

[1] Ownership refers to the farmer's perceived ownership. It may be based on customary rights to harvest coconuts from the trees, or based on trees located on property for which farmer has use rights or title. Calculated for households with coconut trees.

Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

Table 15 Productive coconut trees per household for households with coconut trees, by CLYD zone, based on 2007/8 season

	Number of productive coconut trees owned by household [1]						
CLYD zone	**Median**	**Mean**	S.E. of Mean	95% Confidence interval		DEFF	DEFT
0-10%	7	20	3.8	12.8	27.8	3.8	2.0
11-70%	13	33	10.0	12.7	52.5	1.6	1.3
>70%	2	10	3.1	3.5	15.7	0.6	0.8
Total	7	23	3.5	15.8	29.8	2.1	1.4

[1] Ownership refers to the farmer's perceived ownership. It may be based on customary rights to harvest coconuts from the trees, or based on trees located on property for which farmer has use rights or title.
Testing: Significant differences in mean productive trees: ** A, B > C. ** indicates significant at 5% level.

Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

Looking at issues related to production and incomes, it may be more important to examine the number of productive trees for each household. As expected, the number of productive trees is lower than the total number of trees, with an average of 23 trees for 2007/2008 season (Table 15). Once again, due to skewness of the distribution with a few producers with high numbers, the median stated for the households may better reflect the population. With only 7 producing trees per household across the zones, only in the intermediate CLYD zones does the number reach a median of 13 trees per household.

6.2. Coconuts and intercropped plots

As indicated in Chapter 4, land area in coconuts is difficult to estimate. There are, however, a total of 60 plots (out of 2,100 plots) that have a combination of coconuts and other crops for which we have information. Analysis of these plots may provide some insights, but researchers recognize that coconuts in Zambezia and Nampula Provinces are most commonly found outside the boundaries of such plots. In addition, intercropping may occur on borrowed plots containing coconut trees. In this case, farmers are basically laborers on a plantation, with no rights to the coconuts, but they can plant other things with intercropping, such that farmers may have more experience with intercropping than considered in these 60 plots.

The analysis for this section is based on a combination of information from sections F, E, and M of the FISP survey. The analysis indicates that:

1. 8% of farmers who own coconut trees are interested in acquiring land title, mostly under the high CLYD zone (Table 16),
2. The plots with coconut trees are equally distributed between upland areas and lowland areas. In both cases the major concentration of plots with coconut trees is under regions with 0% CLYD,
3. Plots in zones with lower CLYD incidence tend to be located farther away from farmers' houses than those in the zones with higher incidence of CLYD.
4. No investments in irrigation or other aspects were made in these intercropped plots with coconut trees.

Table 16 Proportion of farmers with intercropped coconut plots who are interested in having land title, by CLYD zone

Interested on having land title	Proportions of plots by CLYD zone			
	0-10%	>10%-70%	>70%	Total
Yes	7%	0%	1%	8%
No	55%	30%	4%	92%
Total	65%	30%	5%	100%

Analysis limited to farmers possessing plots identified as having coconuts and crops (60 farmers and 60 plots).
Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

Table 17 Location of coconut intercropped plots, by CLYD zone

	CLYD zone			
Location	**0-10%**	**>10%-70%**	**>70%**	**Total**
Upland fields	31%	11%	4%	46%
Lowland fields	35%	18%	1%	54%
Total over 60 plots	65%	30%	5%	100%
Traveling time (hours)	0.8	0.5	0.2	0.7

Analysis limited to 60 plots having coconuts and crops.
Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

Table 17 indicates the placement of the fields and the distance from homes. There is little difference between the zones, and plots average less than 1 hour walking time from the homestead.

Results in Table 18 indicate that in general, farmers acquired plots where they grow coconut trees at least one decade ago, and mostly were ceded by their parents, occupied or inherited. One important aspect to note is that 12% of the plots with coconut trees were purchased; this is clear indication that there is land market developing in the region. Unfortunately we cannot say where they did purchase the land, but purchases indicate the development of informal land markets.

Table 18 Coconut intercropped plots by years of possession and source of use rights, by CLYD Zone

		CLYD zone			
		0-10%	**11%-70%**	**>70%**	**Total**
	Time of possession* (years)	15	12	11	13
Source of land use rights**	Ceded by traditional authorities	3%	4%	0%	7%
	Ceded by formal authorities	0%	0%	1%	1%
	Ceded by parents	19%	11%	1%	31%
	Occupied	19%	5%	2%	26%
	Purchased	7%	5%	1%	12%
	Inherited	18%	6%	0%	24%
	Total	**65%**	**30%**	**5%**	**100%**

*Number of obs = 37, **Number of obs = 60.

Only coconut intercropped plots considered (60 plots).
Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population*base is 2009

Farmers reported being involved in land conflict for only 5% of the plots (Table 19), and there was insufficient information to evaluate the type of conflict, the time when it started and ended. Farmers expressed some concern of having land conflict in future. It is unclear if the presence of coconuts helps to establish use rights and that resulted in the low number of conflicts.

Table 19 Proportion of coconut intercropped plots with land conflict and that expect conflict in future, by CLYD Zone

		CLYD Zone			
		0-10%	**11%-70%**	**>70%**	**Total**
Land conflict	Yes	2%	3%	0%	5%
	No	63%	27%	5%	95%
	Total	**65%**	**30%**	**5%**	**100%**
Concerned about land conflict in future	Yes	3%	3%	0%	6%
	No	62%	27%	5%	94%
	Total	**65%**	**30%**	**5%**	**100%**

Only coconut intercropped plots considered (60 plots).
Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

6.3. Percent of coconut tree stock infected with disease

The survey included households in the coconut zone who once had coconut trees and no longer have them. Within the sample, 75 of 771 households indicated previous ownership with loss of trees. When weighted according to population statistics, this is only 3.4% of the farmers in the coconut zones. As can be expected, the majority of these households (60% of them) can be found in the highest incidence CLYD zone, with greater than 70% CLYD, and another 23% are in the 11-70% CLYD zone, providing evidence that the classification of zones makes sense.

Within the highest incidence CLYD zone, fully 26% of the households indicated that they had once had coconut trees and now had none, due to plant diseases and pests. All of the sample households that no longer have coconut trees identified CLYD as a cause of death of the trees, and about 1/3 of the sample households identified rhinoceros beetle as a problem as well.

When asked about how many trees had been affected by the disease, the time frame was not the same recall period and so it would not be justified to calculate a percentage of trees affected in the 2007/2008 period.

6.4. CLYD identification

During the rapid appraisal, it became apparent that farmers were generally able to identify the CLYD, especially in the later stages, and so they were asked several questions concerning the disease and its impact, as well as that of rhinoceros beetles. When asking those households with coconut trees if any trees had been affected by CLYD in the previous 12 months (prior to the survey), 38% of all households indicated that they had affected trees (Table 20). For households that still have coconut trees, 90% of the households in the highest CLYD zone identified the loss of coconut trees due to CLYD. Even in the zones classified as 0-10% CLYD in the rapid appraisal of 2008, 29% of households indicated that they had lost at least some trees due to CLYD.[20] When asked how many trees had died due to CLYD, the counts ran from 1 to 952 trees, with an average of 24 trees and a median of 5 trees, with the highest losses in the highest CLYD zone. It is interesting to note that even in the 0-10% CLYD zone, trees were mostly taken down by the farmers themselves (Table 20).

[20] It will be important for researchers to look carefully to understand if the farmers mis-identified CLYD or if the disease spread since the 2008 Rapid Appraisal.

Table 20 Percentage of farmers indicating disease problems and treatment of dead trees, among farmers with coconut trees

Responses	CLYD zone				Testing for CLYD zones	Male-headed	Female-headed
	0-10% A	11-70% B	>70% C	Overall			
	% of households						
Farmers citing loss of productivity of trees due to any tree disease	34%	47%	68%	39%	** A<C; * B<C	42%	33%
Farmers citing death of a tree due to CLYD	29%	48%	90%	38%	**A,B <C	42%	28%
Farmers indicating that trees were taken down and burned[1]	40%	42%	32%	39%		43%	27%
If trees destroyed, by whom?							
Self	86%	81%	85%	84%		85%	77%
NGO	0%	3%	1%	1%		1%	0%
Private firm	3%	4%	10%	4%		5%	5%
Others (neighbors, relatives)	11%	11%	4%	10%		8%	18%

1 Only for farmers indicating having had problems with CLYD.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

As indicated in Eden-Green (2008), rhinoceros beetles are also a threat to the coconut trees in Zambezia and Nampula Provinces. This question was only asked within the MCA/FISP sample of households, so only 65% of the sample is included in the analysis. In the MCA/FISP coconut growers' survey, some 30% of households indicated that rhinoceros beetles had killed at least one of their coconut trees, and on average 6 trees (median of 3 trees) were killed. These numbers should be used with caution due to the linkages between CLYD, beetles, and problems with identification of cause of death, as well as the lack of information from the TIA 2008 survey.

6.5. Tree removal practices

Eden-Green's work highlights the critical need to take out diseased and dead trees as they are hosts for the rhinoceros beetle, which also can feast off new plantings and kill them. For those households that indicated tree deaths due to CLYD, only 40% of farm households with coconut trees responded that affected trees had been taken down and burned (Table 20). There were no significant differences in this percentage across the CLYD zones; however, female-headed households were less likely to have taken them down, with only 27% of households indicating removal, whereas among male-headed households, 43% indicated removal. Of those with destruction of the trees, 84% had done the work themselves, rather than the work being done by others.

6.6. Production and Income from coconuts and related products

Coconuts are used for both home consumption and sales of a range of products (Table 21 and Table 22). Green coconuts are eaten fresh, first drinking the coconut water and then eating the tender pulp inside. *Sura* is a traditional alcoholic beverage made from an extract of the coconut tree itself (not from the nuts), and extracted in such way that it prevents the formation of the nuts. Copra is the dried white flesh of the coconut, from which coconut oil is extracted. Coconuts may be sold for industrial use or for family consumption, but copra is generally produced for sales directly to industry.

As seen in Table 21, the zones with the highest CLYD have the lowest participation in each of the products. For example, only 38% of coconut households in the highest CLYD zone harvested coconuts and only 5% participated in producing copra in a zone that previously would have been very active in coconut and copra. The average production and sales of copra is still high in the highest CLYD zone, for those households with trees still in production. Female headed households were significantly more likely to produce *sura* than male-headed households, but for the other commodities, there were no significant differences.

Table 21 Percentage of farmers in a given zone that harvested or produced selected coconut products, by CLYD zone

CLYD zone	Green coconut	Coconut	Copra [1]	Sura [2]
0-10%	63%	80%	8%	3%
11-70%	74%	83%	21%	7%
>70%	35%	38%	5%	2%
Total	64%	77%	11%	4%

[1] Copra is the dried white flesh of the coconut, used for extracting coconut oil.

[2] "Sura" is an alcoholic beverage made from extract from the coconut plant.

Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

Table 22 Percentage of farmers in a given zone that sold selected coconut products, by CLYD zone [1]

CLYD zone	Green coconut	Coconut	Copra [2]	Sura [3]
0% CLYD	20%	43%	93%	71%
11-70%	19%	55%	100%	84%
>70%	13%	42%	100%	10%
Total	19%	46%	96%	73%

[1] Percentage based on household producing or harvesting the commodity.

[2] Copra is the dried white flesh of the coconut, used for extracting coconut oil.

[3] "Sura" is an alcoholic beverage made from extract from the coconut plant.

Source: FISP Coconut Farmer Survey 2008. Estimates weighted to reflect population.

Table 23 Coconut quantities produced and quantities sold (in kgs), per household, by CLYD zone

CLYD zone	Median	Mean	S.E. of Mean	95% Confidence interval		DEFF	DEFT
Avereage quantities of coconut produced, across all households producing coconuts							
0-10%	48	105	15	74	135	3.97	2.00
11-70%	44	136	47	41	230	3.94	1.99
>70%	33	64	15	34	94	0.23	0.48
Total	40	112	16	79	144	3.55	1.88
Average quantities of coconut sold, across all households producing coconuts							
0-10%		43	9	26	60	2.99	1.73
11-70%		73	33	8	138	3.85	1.96
>70%		12	6	0	24	0.39	0.62
Total		48	10	29	68	3.20	1.79
Average quantities of coconuts sold, over households selling coconuts							
0-10%	66	125	20	85	165	2.40	1.55
11-70%	66	160	63	35	286	3.04	1.74
>70%	32	78	25	28	127	0.18	0.42
Total	66	135	24	87	183	2.68	1.64

Notes: Production estimates based on households producing; sales estimates based on household producing and on just households selling. Based on coconuts sold as coconuts and does not include coconuts sold in other forms (sura, lanho, etc.)
Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

Table 24 Copra quantities sold, per household (in kgs), by CLYD zone

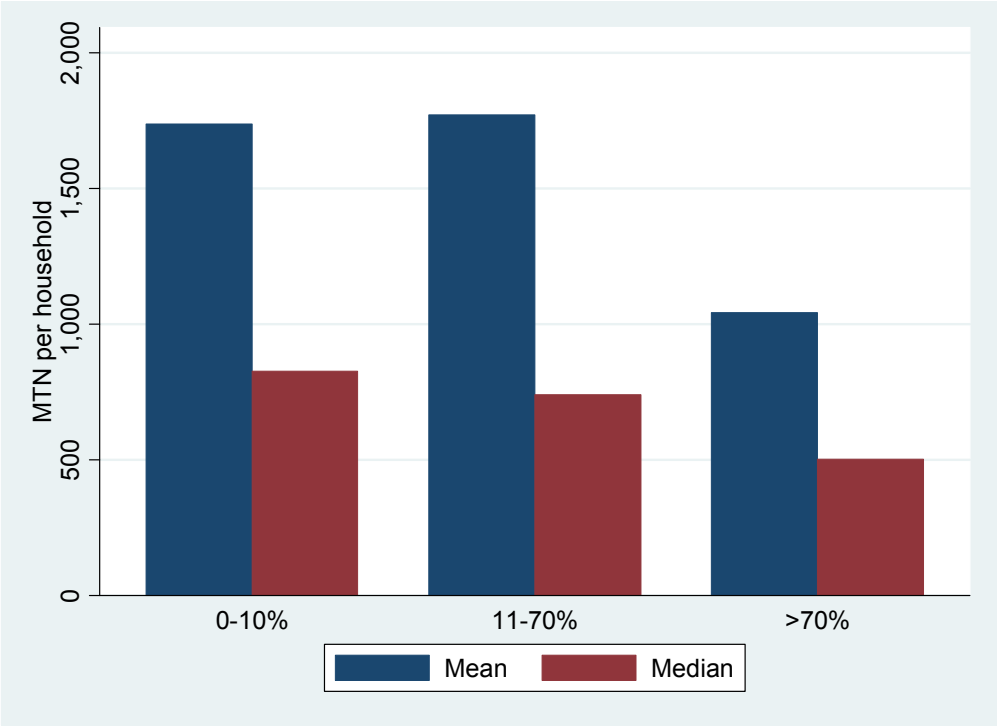
CLYD zone	Median	Mean	S.E. of Mean	95% Confidence interval		DEFF	DEFT
0-10%	94	177	50	77	276	1.50	1.22
11-70%	94	100	11	77	123	0.90	0.95
>70%	141	183	43	95	271	0.29	0.53
Total	94	139	23	91	187	1.38	1.17

Notes: Sales estimates based on households producing and selling. Almost all copra is sold, and thus there are no significant differences between production and sales, and only sales information reported.
Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

As can be seen in Tables 22 and 23, copra is produced for marketed sales for industrial purposes. *Sura* is also produced for local sales. Green coconut is most likely to be consumed at home, rather than sold.

For production and sales quantities, we will focus on the total value of sales of coconuts and copra.[21] As with income, the distribution is skewed (Figure 3), with many households with low income, and a few households with relatively high income, so both the weighted average (mean) and the weighted median are presented, differentiating between using all households and using only households who sold at least some coconut products. As expected, coconut income in 2007/2008 was much lower in the highest CLYD zone than in the other zones, although coconut income is still an important part of household incomes (Table 25). This reflects the lower overall income earned by households in the highest CLYD zone.

Figure 3 Household level coconut product sales value, by CLYD zone, mean and median values (MTN), only using households that sell



Note: Estimates are weighted by population. Income includes green coconuts, mature coconuts, and copra, excluding *sura*. Only households selling some coconut products are included.

Source: Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

[21] Data for *sura* is being analyzed and it was excluded to avoid double counting.

Table 25 Household income from coconut sales (in MTN) and percentage of income from coconuts, by CLYD

Income	Measure	CLYD zone				Testing
		0-10%	11-70%	>70%	Overall	
		A	B	C		
		(value in Meticais)				
Total value of coconut product sales						
All HHs	Mean	655	945	170	691	** A>C; * B>C
	Median	0	128	0	0	
HHs selling coconut products	Mean	1738	1771	1043	1727	**A>C * B>C
	Median	826	739	503	800	
	Sample N	139	103	44	286	
Percentage total income from coconuts for households selling coconuts						
		(% of total income)				
HHs selling coconut products	Mean	15%	18%	15%	16%	
	Median	11%	9%	10%	11%	

Estimates for all households unless indicated otherwise. HHs means households.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008, Estimates weighted to reflect population.

6.6.1. Household coconut income, comparing MCA/FISP households to TIA 2008 in the sample

As discussed briefly in the income section, there is a need to evaluate whether or not the two survey periods result in any data bias. The MCA/FISP survey took place during and after a key period of the year for coconut product sales, whereas the TIA 2008 survey took place six months earlier. Did the MCA/FISP households indicate higher incomes because they looked at a recent sales period rather than the 2007/2008 season? Enumerators were trained to avoid these problems.

Table 26 presents the results of an examination of coconut product incomes, both total income at the household level and the percentage of income coming from coconuts.

Table 26 Comparison of coconut sales values for MCA/FISP and TIA 2008 samples, by CLYD zone, for farmers selling coconuts and copra

Income	Measure	CLYD zone 0-10% A	11-70% B	>70% C	Overall	Testing
Total income from coconut products for households selling coconuts						
				(value in meticais)		
TIA 2008 sample	Mean	1156	3039	[1]	2149	
	Median	681	1200	[1]	878	
	sample N	36	43	2	81	
MCA/FISP sample	Mean	1855	994	1333	1594	** A>B,C
	Median	865	510	758	800	
	sample N	103	60	42	205	
Percentage total income from coconuts for households selling coconuts						
				(% of total income)		
TIA 2008 sample	Mean	11%	23%	[1]	17%	
	Median	6%	17%	[1]	10%	
MCA/FISP sample	Mean	16%	15%	18%	16%	
	Median	12%	5%	14%	11%	

[1] Only 2 households in TIA 2008 in this category, so not reported.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

7. CROPPING AND RELATED ACTIVITIES

7.1. Agricultural activities potentially important to the FISP project

Producers in the coconut zones crop a range of commodities, but there is variability among the CLYD zones (Table 27). Both rice and cassava are key crops in the coconut zones. Cassava is grown by 86% of the smallholders in the coconut region, reaching 95% in the zones of highest CLYD incidence. Sweet potatoes are also commonly grown in the zones with CLYD, reaching 47% of households in both zones with greater than 10% CLYD. Total quantities of each produced, however, are largest in the in lower CLYD zones.

With regard to the cash crops from the TIA[22], only a few households in the 0-10% CLYD zone cultivate cotton and sesame. In the zone with greater than 70% CLYD, none of these crops were grown by smallholders in the 2007/2008 season.

For the types of crops likely to be included for diversification and intercropping, the average mad median household income was estimated and is presented in Table 28. Roots and tubers are the

[22] The cash crops included are cotton, tobacco, sisal, tea, sugarcane, sunflower, sesame, soy, paprika and ginger.

most important across the three zones. Beans and groundnuts are significantly more valuable a source on income in the 0-10% CLYD zone than in the other zones.[23]

Table 27 Percentage of farmers growing crops, by CLYD zone

	CLYD zone				
Crop	**0-10%**	**11-70%**	**>70%**	**Overall**	**Testing**
Maize	38%	33%	37%	37%	
Rice	60%	91%	72%	69%	**A<B
Sorghum	4%	1%	0%	3%	** A>C
Millet	1%	0%	0%	1%	
Large Groundnuts	6%	2%	1%	5%	*A>B
Small Groundnuts	38%	13%	9%	29%	**A>B,C
Pulses					
Common beans	1%	6%	0%	2%	*A<B
Cowpeas	47%	52%	65%	49%	**A<C
Earth pea "jugo"	23%	2%	10%	16%	**A>B,C
Pigeon pea	25%	8%	3%	19%	**A>B,C
Mung beans	5%	2%	16%	5%	*B<C
Roots and Tubers					
Cassava	83%	81%	94%	83%	**B<C *A<C
Orange-fleshed sweet potato	3%	1%	2%	3%	
White fleshed sweet potato	32%	47%	47%	37%	*A<C
Cash crops [1]					
Sesame	3%	0%	0%	2%	
Sugar cane	9%	16%	8%	11%	** B>C

1 Cash crops such as cotton, tobacco, paprika, and soybeans, were not grown in this region.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

[23] The data can be further disaggregated for purposes of FISP programming.

Table 28 Income from selected crops, net of cash inputs, all households, by CLYD zone

Income	Measure	CLYD zone				
		0-10%	11-70%	>70%	Overall	Testing
Total value of cereals production (net cots of cash inputs)						
	Mean	1506	1321	950	1416	
	Median	525	764	419	605	
Total value of beans and groundnuts production (net cost of cash inputs)						**
	Mean	645	184	140	488	A>B,C
	Median	150	20	23	88	
Total value of roots and tubers production (net cost of cash income)						
	Mean	3750	3623	2849	3648	
	Median	1393	1524	1290	1403	
Total value of fruits and vegetables (net cost of cash income)						
	Mean	427	76	34	308	
	Median	0	0	0	0	

Estimates for all households unless indicated otherwise. HHS means households
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.

Source: FISP Coconut Farmer Survey, 2008. Estimates weighted to reflect population.

7.2. Extension Services

Given the agricultural base of the economy in these coconut zones, farmers need access to information on production technology, diversification strategies, and ways to counteract pests and diseases. The public extension services have not been able to reach many producers and the survey does not indicate a strong NGO presence for the cropping year 2007/2008. Thus, only 7% of farmers indicate that they or someone in the household received extension information or advice (Table 29). It was not uncommon for both men and women to receive advice. Most often the information concerned agriculture (Table 30), and in the 0-10% CLYD zone, livestock and processing information was also received. Market information seemed to be concentrated in the 11-70% CLYD zone.

Table 29 Households receiving information or advice from an extension agent, by CLYD zone

CLYD zone		Received extension info	Of those receiving, gender of person receiving		
			Men	Women	Both
0% CLYD	A	8%	29%	23%	48%
11-70%	B	5%	52%	9%	39%
>70%	C	3%	28%	20%	52%
Overall		7%	33%	21%	46%
Testing		* A>C			

Testing: * indicates significant difference at 10% level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Table 30 Sector for which information or advice received, for households receiving information

CLYD zone	Sector for which information or advice received					
	Agriculture	Livestock	Forestry	Fish farming	Processing	Markets
0-10%	100%	22%	2%	2%	6%	6%
11-70%	96%	14%	1%	0%	0%	39%
>70%	100%	18%	9%	0%	0%	0%
Overall	99%	21%	2%	2%	4%	12%

Testing was completed and no significant differences found between CLYD zones.

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Extension agents are increasingly being asked to assist farmers with the marketing of their products, whether providing information on possible markets, commodities with good sales potential, or prices for commodities. The survey asked specifically about the receipt of market price information and we found that this information was received by about 30% of the coconut farmers in the region (Table 31). Radio was the most common single source of information Table 31). One of the radio sources is the MINAG *Sistema de Informação de Mercados Agrícolas* (SIMA) and its Nampula provincial SIMAP have broadcast market price information on national and local stations, although not consistently in 2008.

Table 31 Percentage of farmers receiving price information and source of information, by CLYD zone

CLYD zone		Received any price info	For farmers receiving price information, the source of the information					
			Radio	Association	Extension	Publications	NGO	Other
0-10%	A	34%	57%	16%	9%	11%	6%	37%
11-70%	B	19%	51%	14%	0%	7%	0%	51%
>70%	C	29%	54%	1%	0%	5%	0%	49%
Overall		30%	55%	14%	7%	10%	4%	40%
Testing			* A>B	** A>C				

Note: Farmers could have more than one source of information. Others include friends and traders, among others.
Testing: * indicates significant difference at 10% level; ** significant at 5% level. If not noted, no significant differences found.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

7.3. Crops grown, intercropped with coconut trees

While the number of plots for analysis is limited to 60, as explained above, it is valuable to look at the crops that can by found intercropped with coconut trees in these plots. Table 32 indicates that rice and cassava are the commonly grown crops in the study area, grown in a total of 26% and 30% of plots in the area, respectively. The second group of crops comprises maize, cowpea and pigeon peas grown in less than 10% of the intercropped plots in the study area, with concentration in the CLYD zones.

Table 32 Percentage of plots growing specific crops, by CLYD zone

	CLYD Zone			
Crops	**0-10%**	**>10-70%**	**>70%**	**Overall**
Maize	4%	1%	0%	7%
Rice	14%	9%	3%	26%
Sorghum	1%	0%	0%	1%
Groundnut (large seed)	1%	0%	0%	1%
Groundnut (small seed)	6%	1%	0%	7%
Cowpea	5%	1%	1%	8%
Bambara nut	4%	0%	0%	4%
Pigeon pea	4%	1%	0%	6%
Cassava	19%	6%	3%	30%
Sweet potato	3%	1%	0%	4%
Cane	0%	0%	0%	1%
Pumpkin	1%	0%	0%	1%
Cucumber	0%	0%	0%	1%
Total	**70%**	**22%**	**8%**	**100%**
Number of obs = 3219				

Note: These are intercropped plots, so more than one crop on a plot.
Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Results in Table 33 indicate that in the 60 plots with coconut trees, the number of crops that coconut trees are intercropped with range from one to seven, with major proportion between one and 3 crops (75%) and minor part composed by more than 3 crops (25%).

Table 33 Proportion of number of crops intercropped with coconut trees

Number of crops intercropped	Total Proportions	Aggregated proportions
1	15%	75%
2	38%	
3	21%	
4	9%	25%
6	6%	
7	10%	
Total	**100%**	

Source: FISP Coconut Farmer Survey, 2008/9.
Estimates weighted to reflect population.

The 75% of plots with up to 3 crops intercropped with coconut trees, rice and cassava are the most commonly intercropped crops (Table 34). In most cases, when cassava is grown along the road, it is with alternating rice and coconut tree bands (Payongayong, 2008). In essence there are few crops truly grown in intercropping with coconut. A special attention should be paid interpreting results reported for intercropping with rice, because in many cases what is reported as intercropping refers to rice grown alternating with coconut bands or rice fields alternating with other trees and few coconut trees (Payongayong, 2008). Having this in mind, the number of crops under intercropping with coconut trees reduces even more.

The analysis above focuses on the limited number of plots with intercropping and coconut trees. Looking across the cropping system, beyond coconuts, intercropping is a common practice in Zambezia and Nampula. During the Rapid Appraisal we observed that cassava and cowpeas are present in the post-endemic areas, where coconut trees used to be grown, but were lost to CLYD (Payongayong, 2008).

In our analysis we did not consider the intercropping with cashew trees. Including cashew trees, the number of intercropped plots would increase. Field observations as reported by Payongayong (2008) indicate that in low-lying areas with no visible CLYD there are coconut/other tree combination alternating rice fields.

Table 34 Identification of crops found in intercropping with coconut, based on number of different crops in plot

	Proportions		
Crops	For plots with up to 3 crops	For plots with more than 3 crops	Total
Maize	2%	5%	7%
Rice	13%	0%	13%
Sorghum	0%	1%	1%
Millet	0%	1%	1%
Ground nut (large seed)	3%	0%	3%
Ground nut (small seed)	5%	2%	8%
Cowpea	4%	2%	6%
Earth peas	1%	1%	3%
Pigeon pea	5%	4%	9%
Cassava	30%	2%	32%
Sweet potato	0%	2%	2%
Sweet potato (orange)	7%	2%	10%
Bambara nuts	0%	1%	1%
Cane	4%	0%	4%
Total	75%	25%	100%

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

7.4. Use of agricultural technologies (crop rotation, fertilizers, row planting, etc.)

Few farmers in Mozambique have adopted the use of new cropping methods and new technologies and farmers in the coconut zone demonstrate the same tendency. While intercropping is quite common, crop rotation and line planting are both practiced by one third or less of farmers overall (Table 35).

Table 35 Percentage of farmers using specific agricultural practices, by CLYD zone

	Use the following agricultural practices		
CLYD zone	Crop rotation	Intercropping	Line planting
0-10%	31%	72%	26%
11-70%	33%	74%	18%
>70%	36%	72%	19%
Overall	32%	73%	23%

Note: Farmers could use more than one practice.
Testing: No significant differences found among CLYD zones.

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

Less than 1% of the households used fertilizer or pesticides. Compost use was found in less than 1% of the households. In other surveys, these practices tend be to be related to cash cropping (especially cotton, tobacco and sugarcane) which are not commonly grown in the coconut growing zones.

Improved seeds were used for some crops, principally maize, small groundnuts (Spanish-style), and rice (Table 36). No farmers used improved seeds for sorghum; only one farmer use improved millet seeds and only one farmer used improved large groundnut seeds, so those crops of left off Table 36. Regarding fertilizer and pesticides and compost, less than 1% of farmers used these products in their cropping and so not reliable statistics can be generated.

Table 36 Percentage of farmers using improved seeds, by CLYD zone

	Use of improved seeds		
CLYD zone	Maize	Rice	Small groundnut
0-10%	3%	4%	5%
11-70%	13%	1%	7%
>70%	16%	4%	11%
Overall	6%	3%	5%

Note: Only for farmers cultivating a given crop.

Source: FISP Coconut Farmer Survey, 2008/9. Estimates weighted to reflect population.

7.5. Association membership and use of agricultural credit

Both association membership and credit access can be linked to income growth. In the case of the coconut zones of Zambezia and Nampula Province, only 8% of household indicated that someone in the household participated actively in an association. The person participating was a man in 35% of households, a woman in 39% of households, and both men and women activity participated in 26% of the households.

Almost no smallholders in the coconut zones obtained agricultural credit during the 2007/2008 cropping season. Only 2.3% of coconut farmers obtained credit in the past year (23 households in the sample), with about 44% of those receiving credit from the government, another 35% from association, and the remaining from banks, traders and NGOs. The government credit was extended by the District Economic Activities Service, associated with the District Agricultural office. Much of this credit was in-kind for inputs (seeds and fertilizer). The households were asked who in the household received the credit and in 75% of the cases, men received the credit, in 15% of cases, women received it, and in the remaining 10%, it was a combination of men and women.

8. REVIEW OF SURVEY AS A BASELINE FOR FISP

8.1. Key areas of usefulness as a baseline for impact assessment

With the full income components, both farm and nonfarm, the FISP baseline components will be able to assess how households change with time, both in the areas of low CLYD incidence at the time of the original assessment and for those heavily affected by CLYD. By following these

different households, MCA and others will be able to understand which households are able to make improvements to income or assets. Focusing on the income components in this survey helps to identify sources of change, something that a consumption survey would be unable to do.

While some FISP indicators can only be tracked through project recordkeeping, the household surveys do enable us to evaluate several key aspects: 1)Increases in crop income of the crops with expected FISP intervention will be captured; 2) stocks of trees among smallholders and farmer indications of disease; 3) coconut related income; 4) new tree plantings by farmers in the zone; 5) farmers receiving marketing or processing advice; 6) farmers using purchased inputs, including improved seed, fertilizers, and pesticides. Given the variability within strata (CLYD zones) and the changing nature of the zones, it is recommended that analysis of performance be focused on the overall results, not the strata level results.

8.2. Challenges for impact assessment

The Baseline Survey was based on TIA 2008, prior to designation of an implementing partner for FISP. The impact evaluation proposal suggested implementation conducted in such a way as to enable impact evaluation, but it is unknown if that will influence implementation. It is not clear if a true control will be established through timing of interventions or limiting regions of action of FISP.

The TIA collected a substantial amount of information, but if designed solely for impact evaluation baseline, it might have contained additional questions on coconuts. Ideally, the interventions under FISP would have been determined prior to the baseline, such that researchers would be able to ensure that the survey captured a baseline for the interventions. Researchers worked based on the FISP terms of reference, but there are no guarantees that the survey captured a baseline for future interventions.

Researchers identified the rapidly rising incidence of CLYD in certain zones, so areas which may have been in the 0-10% CLYD range may face acute problems with the time frame of the project. Additional monitoring work will be needed to capture the CLYD incidence at the end of the project, using similar diagnostic methods as the rapid appraisal.

8.3. Recommendations for monitoring and evaluation

The baseline survey has generated results that can assist in monitoring and evaluation of the FISP. For example, as FISP implementation moves forward, it will be necessary to understand how farmers define their plots and how coconuts are allocated to land areas. There may not be many actual farmed plots in which plantation style coconut cropping currently occurs but it may be part of a strategy with replanting in post-endemic zones. Many of the indicators for the FISP entail outcomes based on the idea that coconuts are planted plantation style.

Since much of the effort will be on replanting coconut trees and income from those trees will only be available after several years, monitoring and evaluation can focus on the income derived from the other crops on which FISP implementation will be based. Clearly tracking the use of inputs and the crops cultivated will give an idea of progress, since crop diversification and crop income is lowest in the high CLYD incidence areas. Technology adoption levels are very low and changes can easily be identified.

Continued monitoring on the incidence of the disease will be needed, as even in the 0% CLYD zones, farmers identified problems with the disease. As Eden-Green (2008) indicated, the disease can move fast.

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