

Agricultural Activity and Household Characteristics in the SAVA Region of Madagascar

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Study Area: Peripheral Zone of Marojejy National Park; specifically, Manantenina, Matsobe and Mandena villages

Data Collection

Mandena: June 29 - August 2, 2018

Manantenina: June 9 – July 26, 2019

Matsobe: August 8 – August 27, 2019

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Background

Madagascar's economy depends heavily on its agricultural sector, which employs over 80% of the country's population. While agriculture is an essential part of the rural economy, agricultural productivity is constrained by low use of modern agricultural practices, poor transportation and marketing infrastructure, and high vulnerability to climate change (World Bank, 2019). This report focuses on agricultural activity in the SAVA region, in northeastern Madagascar, based on survey data from three villages. The two most important agricultural crops in the area are rice and vanilla, but many other crops are produced by the rural residents who were surveyed.

Part of a larger research project on land use change and human health, this report focuses on the socioeconomic characteristics of participating farmers, including their assets, their livestock and their cropping activities. Particular attention is given to vanilla production, the most important cash crop in the region. Data are also reported on crop diversification and food insecurity. The purpose of the report is to provide an overall picture of agricultural activity in the SAVA region and compare that activity across villages.

Methods

The data for this report were collected in three villages between the months of June and August, over two consecutive years: in Mandena in 2018, and in Manantenina and Matsobe in 2019. The household survey instrument underwent minor changes between its first implementation in Mandena and subsequent implementation in Manantenina and Matsobe. The survey was geared at understanding household member's agricultural practices, sustainable farming practices, health seeking behavior, and health care accessibility, and also collected information on demographic characteristics, and various wealth indicators. The survey team included Duke University students, staff, faculty and local Malagasy researchers. The process of selecting which households would be surveyed varied by village. In Mandena, a drone image of the village was used to map out a grid system, which resulted in two-stage random sampling of households in different areas of the village. In Manantenina, a member of the research team who lived in the village provided a complete list of all village residents, which was used to reach as many village members as possible. In Matsobe, 2018-2019 census data were used to randomly select households.

In Mandena, 94 household surveys were completed, in Manantenina, 150 household surveys were completed, and in Matsobe, 110 household surveys were completed. An attempt was made to identify one person to survey within each household and to balance the overall mix of males and females across the sample. All surveys were administered in the local dialect of Malagasy, and informed consent was obtained from all study participants prior to taking the survey. A local research team member, fluent in both Malagasy Official, and the local dialect, conducted the informed consent and survey with the study participants. The surveys were implemented using Qualtrics software on Samsung tablets, and took between 20 and 60 minutes to complete. Study participants were compensated with 1,000 Ariary (MGA) in mobile phone credit upon survey completion.

The data were cleaned and analyses were conducted in R. Descriptive statistics were used to present demographic characteristics, household assets, household ownership of livestock, crop diversification, food insecurity, energy and fuel, as well as gender differences.

Results

Demographics

Demographic characteristics were similar across the three villages (Table 1). Nearly half of the respondents in Manantenina completed secondary school, as compared to 40% in Matsobe and 36% in Mandena. Mandena also had the highest percentage (17%) with no formal education. Approximately 40% of study participants attended secondary schooling or higher, and nearly 90% stated that their main household activity was farming. Most participants attended public school and are married or living with their partner. Of those surveyed, nearly 50% were male and 50% female. Specifically, in Matsobe and Mandena 56% were female, and in Manantenina 51% were female. The mean household size varied between 3.8 and 4.3 people across villages. Table 1 and Table A1 (appendix) provide additional demographic information.

Demographic Characteristic	Manantenina N (%) N = 150	Mandena N (%) N = 94	Matsobe N (%) N = 110
Male	74 (49)	41 (44)	48 (44)
Mean age	41.8	45.8	44.1
Education completed			
Primary	69 (46)	43 (47)	56 (51)
Secondary or Higher	71 (48)	33 (36)	44 (40)
Never attended school	9 (6)	15 (17)	8 (7)
Marital status			
Married / Living together	109 (72)	58 (62)	68 (62)
Never married / Never lived together	27 (18)	5 (5)	27 (25)
Separated / Divorced / Widowed	14 (10)	31 (33)	14 (13)
Average number of people living in HH	4.4	3.8	4.3
HH main activity			
Farming	135 (90)	86 (91)	93 (86)
Other*	15 (11)	8 (9)	15 (14)

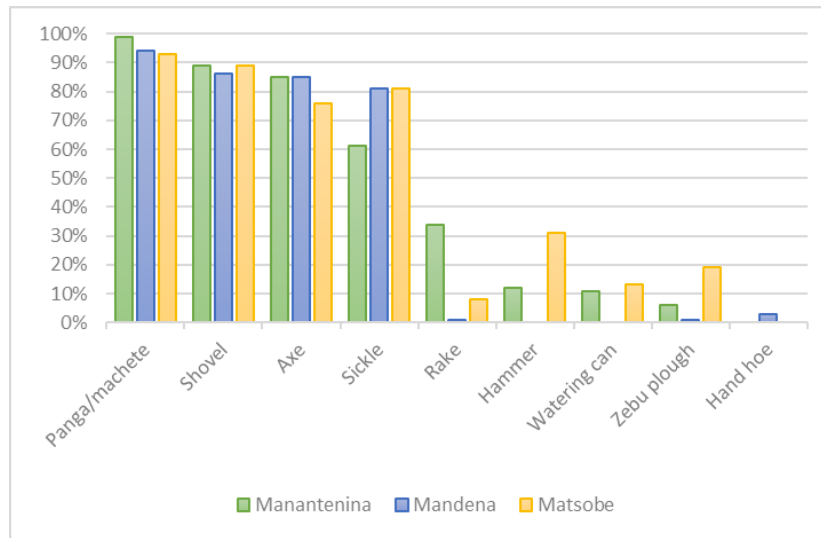
* HH Main Activity Other Manantenina included: hairdresser, housewife, buyer of vanilla, mechanic, photographer, retired, secretary for mayor, tailor, teacher, works at a shop, and works at Marojejy reception. Other Matsobe included pastor, community health worker, student, teacher, works at a shop, and unemployed. Other Mandena included self-employed, unemployed, wage labor/salaried work.

Assets

While about 90% of individuals own their home, very few individuals have a bank account; 21%, 16%, and 9% of participants in Manantenina, Mandena, and Matsobe, respectively (Table A2). Reasons for not having a bank account did not vary much; over 90% of individuals across all three villages cited not having enough money as the primary reason for not having a bank account. Mobile phone ownership varied somewhat across villages, with 78%, 59%, and 66% mobile phone ownership in Manantenina, Mandena, and Matsobe, respectively. Participants indicated using their mobile devices for mobile banking or to send and receive money more often than they reported having a bank account. In Manantenina 21% had a bank account, and 33% used mobile banking; in Matsobe 9% had a bank account, and 23% used mobile banking. Households most frequently owned the basic agriculture tools; e.g., a machete, shovel, axe, and sickle (Figure 1). More advanced tools, such as zebu ploughs, were rarely owned (1% in Mandena, 20% in Matsobe). Household flooring and walls were primarily constructed out of material that had been collected, rather than purchased, except roofing material was primarily purchased, which included metal sheets (iron / aluminum), as well as concrete and cement. Collected flooring and wall material primarily

consisted of bamboo wood, wood planks, and raffia palm. Additional information on household assets can be found in Table A2 in the appendix.

Figure 1. Household Ownership of Agricultural Tools



Livestock

Most respondents owned poultry, with up to 100% ownership in Manantenina and Mandena. Poultry included chickens, geese, and ducks. Most participants owned chickens, followed by geese and then ducks. Fewer participants reported owning zebu and pigs, and even less reported owning other animals such as sheep, rabbits, goats, and fish (Figure 2). Zebu were most common in Matsobe, where 45% of respondents owned at least 1, as compared to 23% in Manantenina and 19% in Mandena. Figure 3 combines livestock ownership across all three villages, and shows the distribution in number of livestock owned. In terms of poultry ownership, it was more typical for a household to own more than five chickens, geese, or ducks. Whereas for zebu and pigs, it was more common for households to own one to three of each. See table A3 for additional information on livestock ownership.

Figure 2: Household Ownership of Livestock

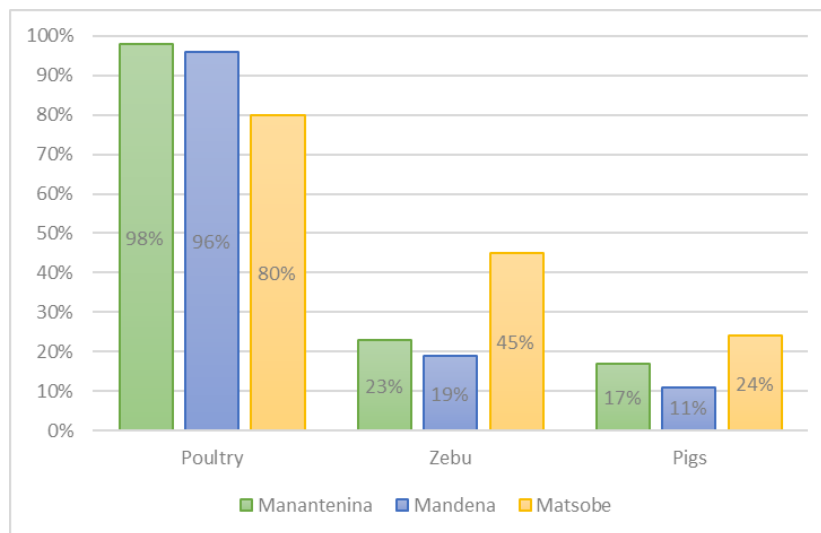
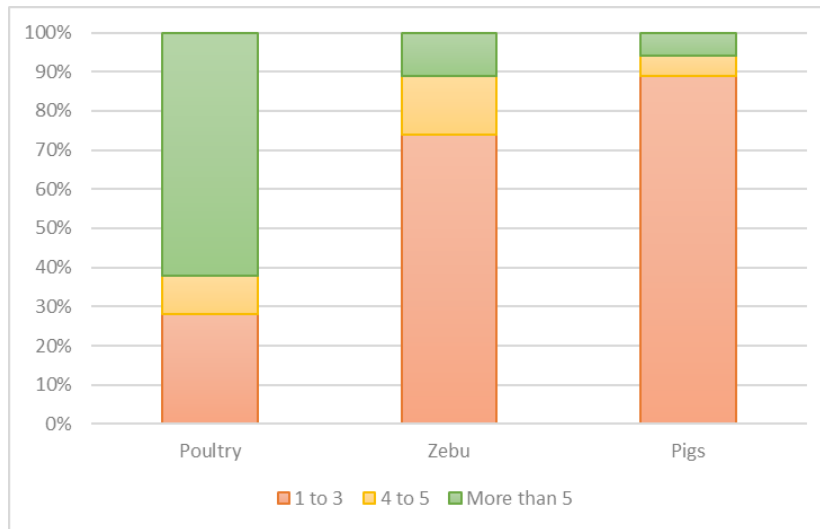


Figure 3: Number of Livestock Owned, Combined Villages



Crop Farming (including vanilla and rice)

Across all three villages, nearly 90% of respondents reported crop farming as their main activity, and over 90% of participants reported having grown crops in the past year. There were a wide variety of crops grown, with the most common being rice, vanilla, bananas, coffee, coconut, avocado, cassava, pineapple, and sugar cane (Table A4, Figure 4). Coffee, bananas and avocados are much more commonly grown in Mandena than in the other villages. Another noticeable difference is that beans are grown by 20 percent of Matsobe households, while 0-1% in the other two villages. While there were many different crops reported, three fourths of respondents grew four crops or less, and 45% grew only one or two crops (Figure 5). Among the remaining 25% of respondents, most grew between 5 and 8 crops, and only one person reported growing as many as 21 different crops.

Rice and vanilla are the two most widely grown crops in the SAVA region. Three fourths of participants reported growing rice in the past year, with most respondents indicating they grew paddy rice only, rather than hillside rice or both (Table A5, Figure 6). The median amount of rice harvested in Matsobe (900 kg) was much greater than in Manantenina (300 kg) and Mandena (456 kg). Loss of seasonal harvests places a tremendous burden on households; respondents noted that loss of rice harvests is typically due to animal consumption (rodents, birds, and insects), with losses ranging from 32 - 75 kilos per year. While rice is most typically grown for home consumption, vanilla is grown as a cash crop. It is sold most commonly to a vanilla certification program or in the village market to vanilla collectors.

Figure 4: Crop Diversification

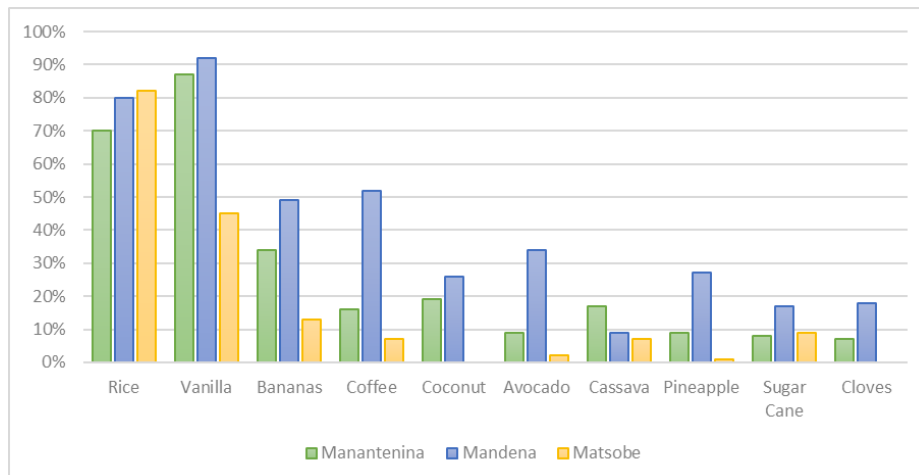


Figure 5: Percentage of Respondents Who Grew Different Crops

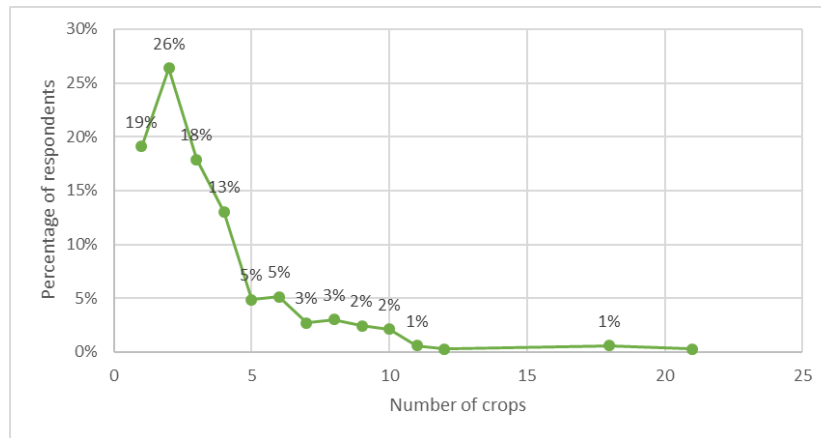
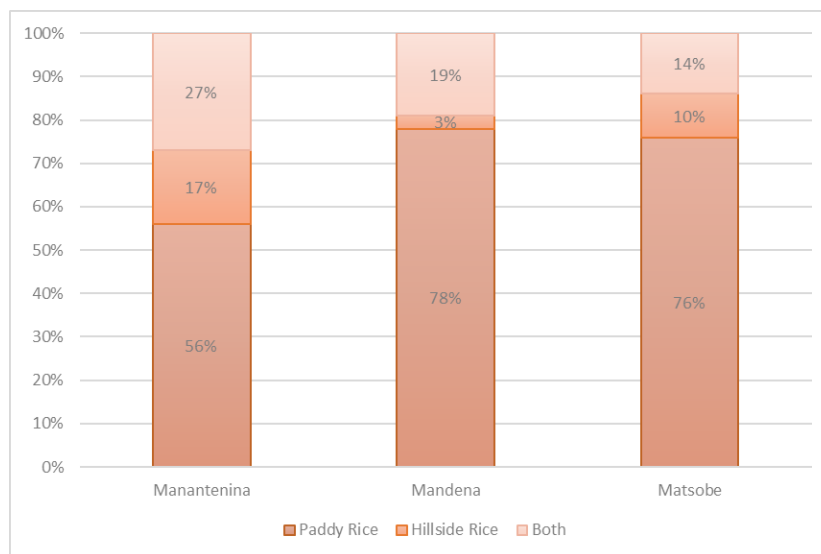


Figure 6. Paddy Rice vs. Hillside Rice



Vanilla Production and Certification

Vanilla was grown by nearly 90% of all respondents in Manantenina and Mandena, while in Matsobe, only 45% reported growing vanilla in the past year (Matsobe significantly lower, logistic regression, $t=8.8$, $p<0.001$). Several certification programs are available to farmers in the SAVA region. These programs provide agricultural advice, marketing assistance and other services to farmer, as well as price incentives for participation. Manantenina had significantly higher engagement in these programs than the other villages, with 61% of those growing vanilla participating, compared to 41% of surveyed growers in Mandena and only 6% in Matsobe (logistic regression, $t=15.13$, $p<0.001$, Figure 7). The two most popular certification programs were Symrise and Tsara Kalitao. Vanilla was most commonly grown on land with secondary vegetation growth, 4 years after slash and burn, and on trees that were specifically planted as tutor trees that were 2 to 4 years old (Table A6). Theft of the vanilla crop is a concern in all 3 villages. The median number of kilos of vanilla harvested by farmers was 20, 10 and 20 in Manantenina, Mandena, and Matsobe respectively. Losses can be tremendous, due most frequently to theft (reported by 22%, 76%, and 100% of households in Manantenina, Mandena and Matsobe, respectively), and resulting in the loss of a few kilos to the entire crop of several hundred kilos (Figure 9).

Figure 7. Participation in Vanilla Certification Program

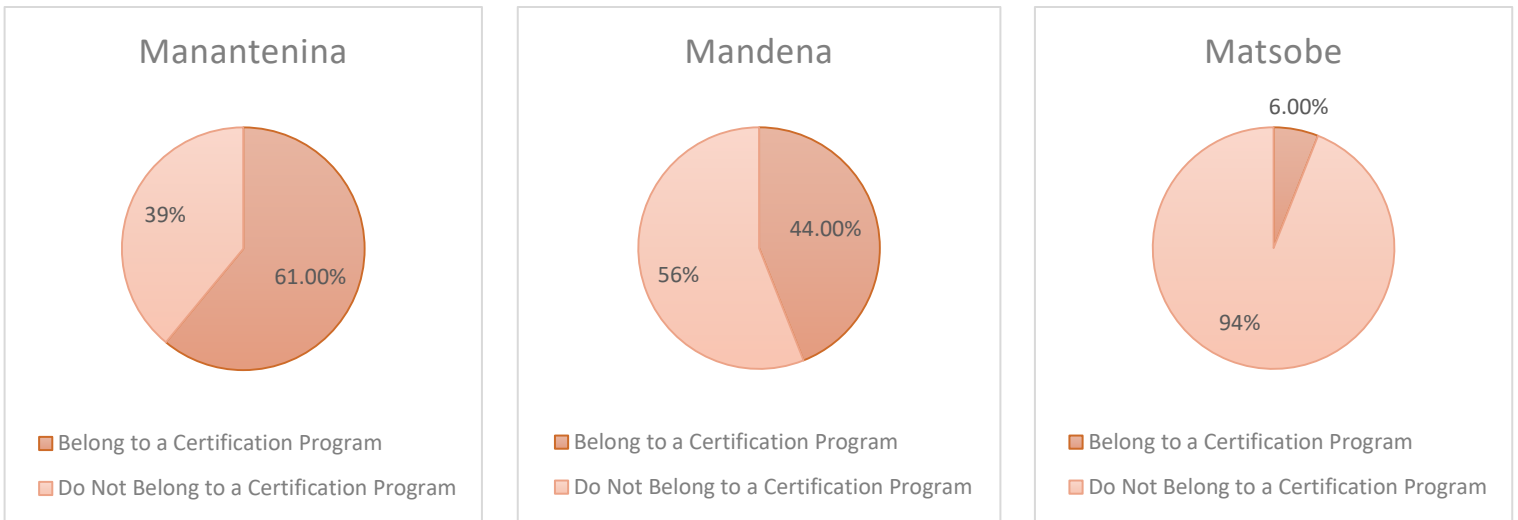


Figure 8: Vanilla Certification Programs Villagers Belong To

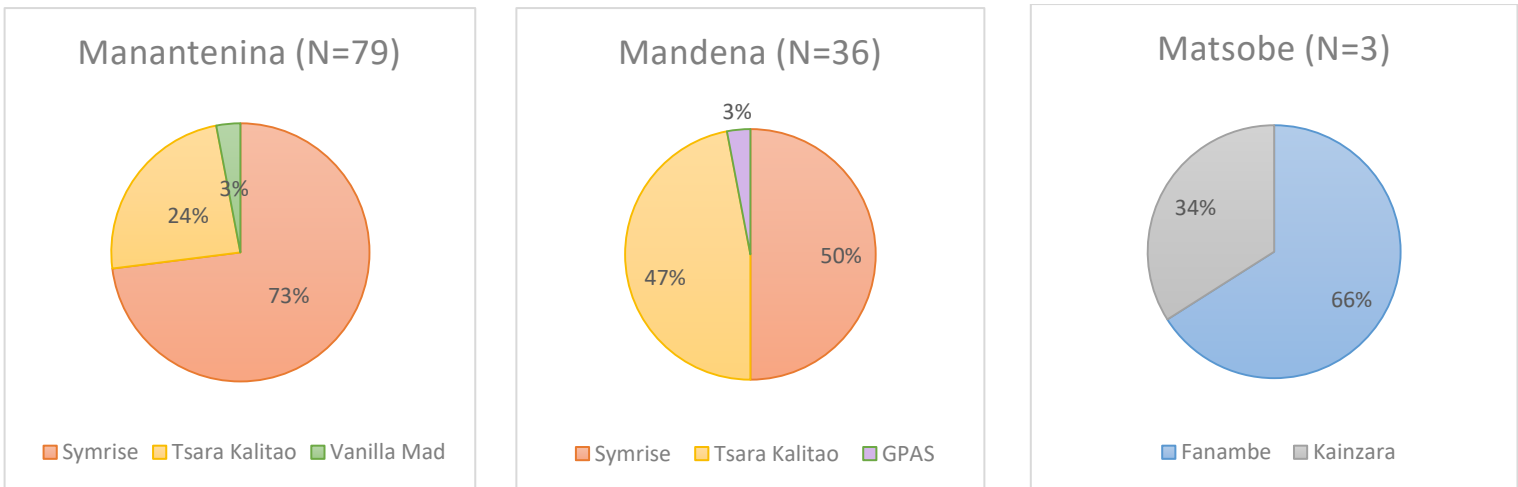
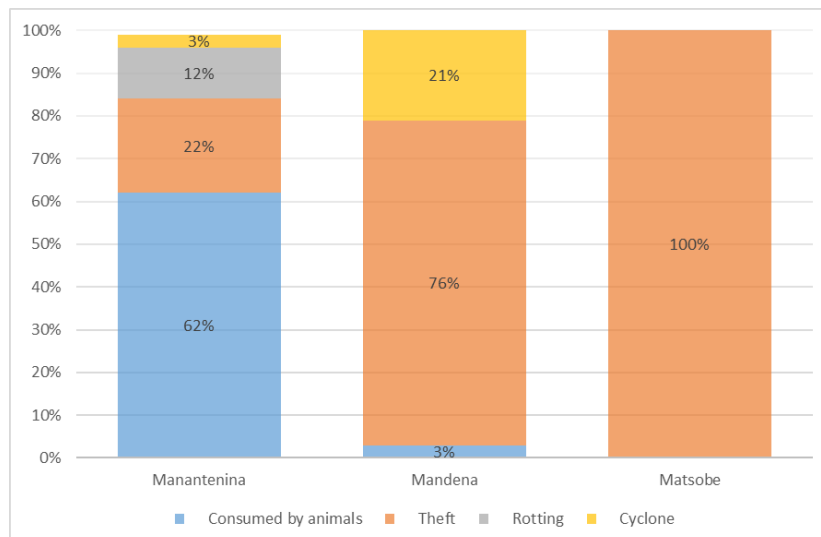


Figure 9: Cause of Vanilla Loss



Food Insecurity

Survey respondents were asked if there had been times during the past three years when they did not have enough food for their household. Approximately 70% or more of respondents reported food insecurity in these villages (Figure 10). More than half of the households in all villages reported the cause of food insecurity was inadequate food supply due to small land size. Drought was mentioned more frequently in Mandena (24%) than in the other villages, but that may be because the Mandena survey was conducted a year earlier, in 2018 (Table A7, Figure 111).

Figure 10. Household Experienced Food Insecurity in Past 3 Years

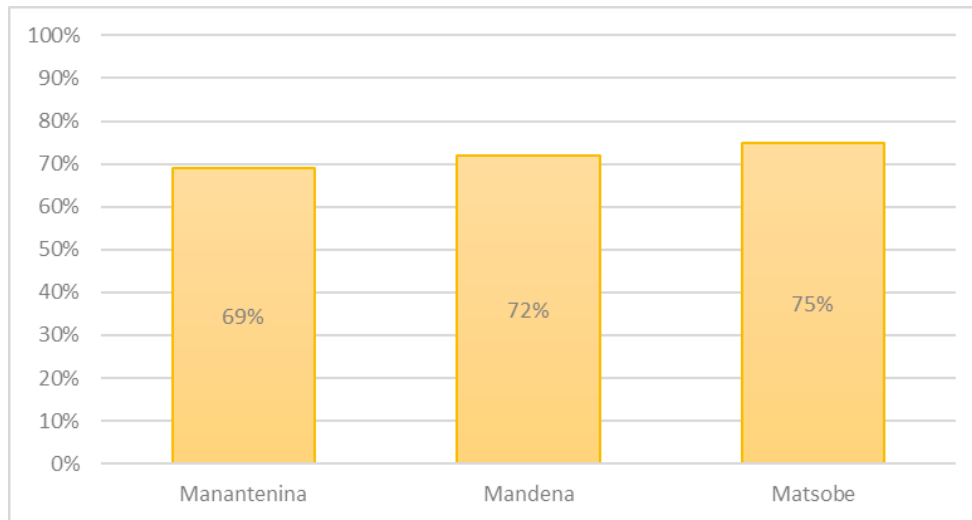
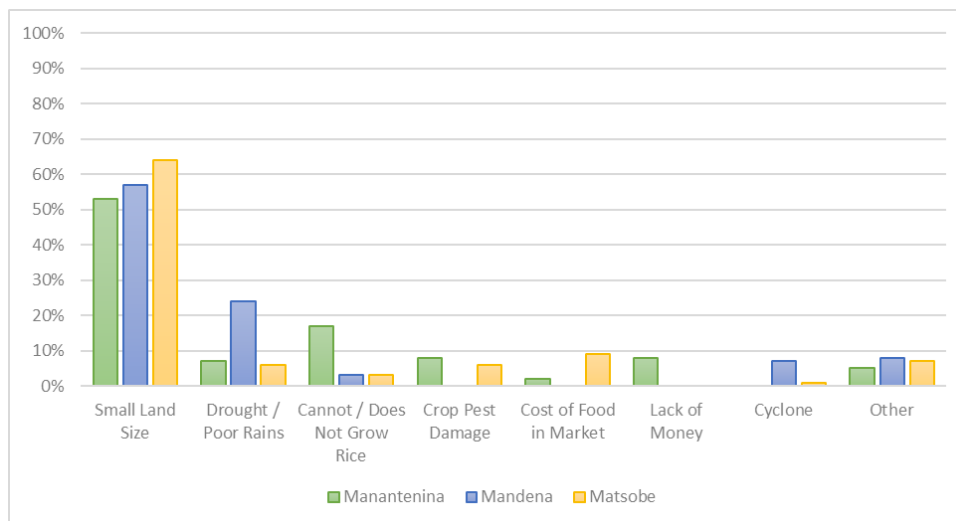


Figure 11. Causes of Food Insecurity



Health & Environment

One difference between villages was the proportion of respondents who had health insurance coverage. While 51% and 41% of individuals were covered by health insurance in Manantenina and Mandena, respectively, no respondents in Matsobe were covered by health insurance. In Manantenina, 71% of those who had health insurance were covered by their vanilla certification program, and while we do not have this information for Mandena, it is possible that the lack of health insurance coverage in Matsobe could be due to the fact that only 6% of respondents belonged to a vanilla certification program, compared to 61% and 44% in Manantenina and Mandena, respectively.

Matsobe also differed from Manantenina and Mandena in terms of their main water source for cooking, drinking, and handwashing and primary fuel type for cooking. Respondents in Matsobe were more likely to use piped water (41%) or water from an open well (39%), and less likely to use water from a spring / river (20%). While in Manantenina and Mandena nearly all respondents indicated they used water from a spring / river for cooking, drinking and handwashing (multinomial regression, likelihood ratio against the null = 257.49, $p < 0.001$). Additionally, while the most commonly reported fuel used for cooking was collected fuelwood across all three villages, Matsobe had the greatest variety in fuel type for cooking; 21% of respondents indicated using purchased fuelwood, and 14% indicated using charcoal for cooking (see Figure 13). See Table A8 in appendix for additional information on health.

Figure 12. Main Cooking, Drinking and Handwashing Water Source

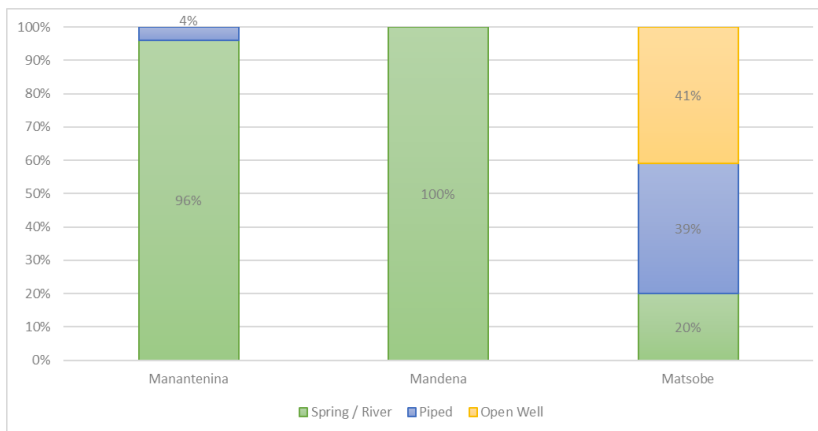
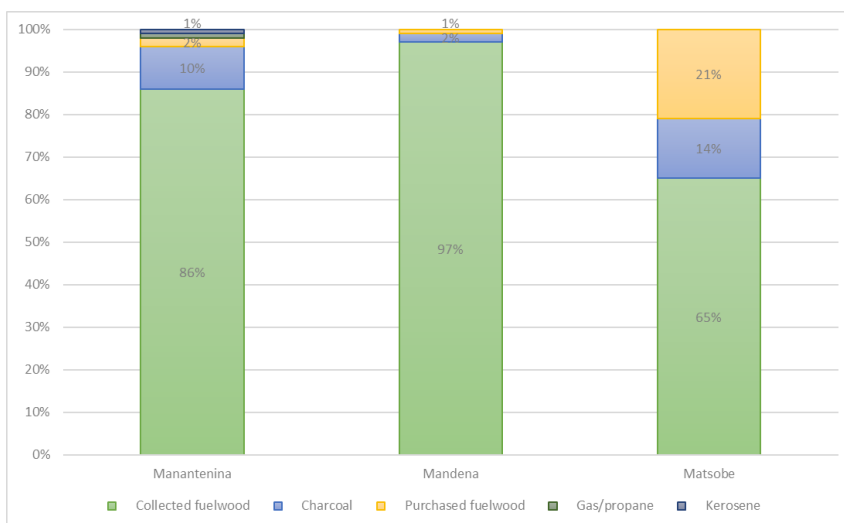


Figure 13: Primary Fuel Type for Cooking

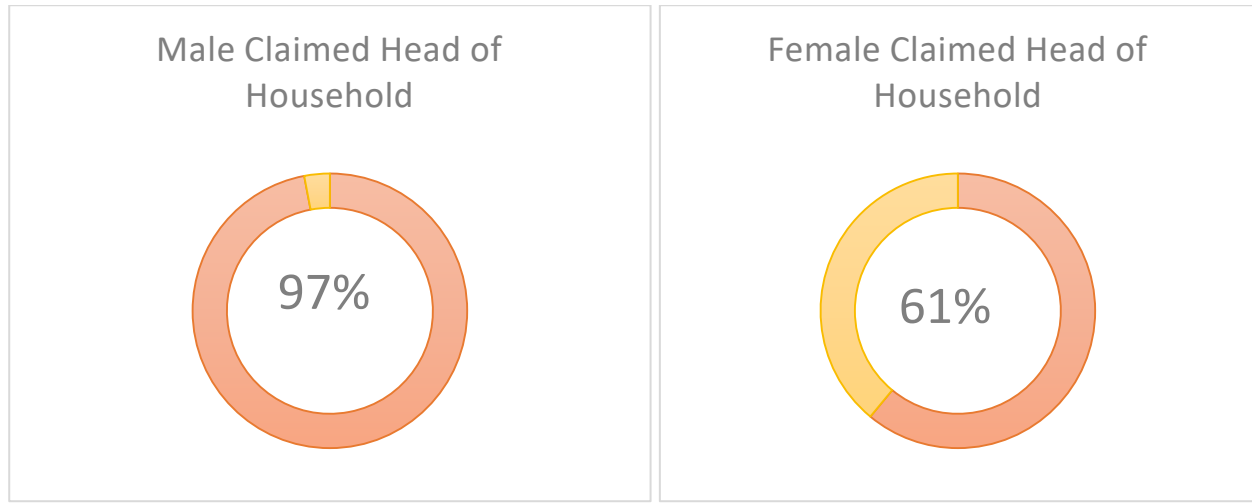


Gender Differences

Across all villages, the goal was to survey equal proportions of men and women. When comparing across genders there was little difference in age, main activity, and health insurance coverage, but there were notable differences in head of household, education, mobile phone ownership and usage, and reporting of food insecurity. After combining data from all three villages, 97% of surveyed males stated they were the head of the household, compared to 61% of surveyed females who claimed to be the head of their household (Figure 14). Fewer women reported that they attended school than men, but there were no notable differences in level of education completed between men and women. Approximately equal proportions of men women owned a mobile phone (72 and 66%, respectively, logistic regression, $t=0.87$, $p=0.39$), and used their mobile phone for mobile banking (26 and 31%, respectively, logistic regression, $t=0.87$, $p=0.39$). Men were slightly more likely to

report food insecurity in the past three years than women, (76% of men and 67% of women, $t=1.67$, $p=0.1$). Lastly, in Manantenina and Mandena villages, women were slightly more likely to belong to a vanilla certification program (logistic regression, $t=-1.88$, $p=0.07$).

Figure 14: Self-Reported Male vs. Female Heads of Household



Summary of Key Points

- **Demographics:** There were minimal differences in demographic characteristics across villages, but comparisons across genders indicated women were less likely to have been to school, but more likely to participate in a vanilla certification program, and were more likely to use mobile phones for banking purposes. Further investigation on women's role in managing finances and certification program enrollment could be helpful in identifying ways to improve income stability.
- **Assets:** Nearly all households reported ownership of agricultural land. Mobile phones were the most widely owned household items, with a higher level of mobile phone ownership in Manantenina. Bicycles were more common in Matsobe.
- **Livestock:** Poultry was the most common livestock owned in the villages. Nearly half of the households in Matsobe reported owning one or more zebu.
- **Crops:** While there were a wide range of crop varieties grown across villages, the most common were rice and vanilla. Rice is important for food security and vanilla is a major source of cash income. Other important crops include bananas, coffee, coconut, avocado, cassava, pineapple, and sugar cane. Tree crops are especially important in Mandena. There are substantial issues of rice loss due to rodents, birds, and insects. Ways to reduce such losses need to be explored, for example, improved grain storage methods could reduce post-harvest losses to rodents and other pests.
- **Vanilla:** Vanilla theft is a significant problem, and efforts to reduce the economic impact this has on villages should be addressed. This could be encouraged by the organizations running certification programs through training and assistance with secure storage.
- **Food Insecurity:** Food insecurity is a substantial issue across all villages, mostly due to small land size. Additionally, while there were a wide range of crops reported, very few people grow crops outside of the top ten listed above, and very few people (about 25%) grow more than 4 different crops. Training for sustainable agriculture, and encouraging greater crop diversification, could be beneficial in improving food insecurity. This is a current programmatic emphasis of the Duke Lemur Center SAVA Conservation program in SAVA region

Appendix

Table A1: Demographic Characteristics

Demographic Characteristic	Manantenina N (%) N = 150	Mandena N (%) N = 94	Matsobe N (%) N = 110
Male	74 (49)	41 (44)	48 (44)
Female	76 (51)	53 (56)	62 (56)
Mean age	41.8	45.8	44.1
Education completed			
Primary	69 (46)	43 (47)	56 (51)
Secondary	52 (35)	29 (32)	36 (33)
Higher	19 (13)	4 (4)	8 (7)
Never attended school	9 (6)	15 (17)	8 (7)
Type of school			
Public school	123 (88)	-	88 (86)
Private school	17 (12)	-	14 (14)
Religion			
Protestant	62 (41)	42 (44)	49 (45)
Catholic	45 (30)	28 (30)	21 (19)
No religion	23 (16)	24 (26)	34 (31)
Traditional / Ancestral	14 (9)	0	2 (2)
Other	6 (4)	0	4 (3)
Marital status			
Married / Living together	109 (72)	58 (62)	68 (62)
Never married / Never lived together	27 (18)	5 (5)	27 (25)
Separated / Divorced	7 (5)	25 (27)	9 (8)
Widowed	7 (5)	6 (6)	5 (5)
Average number of people living in HH	4.4	3.8	4.3
HH main activity			
Farming	135 (90)	86 (91)	93 (86)
Teacher	4 (3)	0	2 (2)
Works at the shop	1	0	7 (6)
Other*	10 (7)	8 (9)	6 (6)

* HH = Household; HH Main Activity Other Manantenina included: hairdresser, housewife, buyer of vanilla, mechanic, photographer, retired, secretary for mayor, tailor, teacher, and works at Marojejy reception. Other Matsobe included pastor, community health worker, student, and unemployed. Other Mandena included self-employed, unemployed, wage labor/salaried work.

Table A2: Assets

Variable	Manantenina N (%) N = 150	Mandena N (%) N = 94	Matsobe N (%) N = 110
HH member owns home	135 (90)	-	100 (91)
HH member has bank account	31 (21)	15 (16)	10 (9)
HH member uses mobile banking	50 (33)	-	25 (23)
Reasons for not having bank account			
Not enough money	113 (95)	72 (91)	94 (94)
It is inconvenient	3 (2)	3 (4)	6 (6)
Lack of trust in banks	1 (1)	1 (1)	0
Not in the habit	2 (2)	0	0
Fees are too expensive	0	3 (4)	0
HH member ever had loan (OTIV/microfinance)	18 (12)	-	4 (4)
Outer walls predominant material			
Purchased	3 (2)	7 (7)	10 (9)
Collected	147 (98)	87 (93)	100 (91)
Roof predominant material			
Purchased	146 (98)	80 (85)	110 (100)
Collected	4 (2)	14 (15)	0
Floor predominant material			
Purchased	65 (43)	27 (29)	47 (43)
Collected	85 (57)	66 (71)	63 (57)
HH member owns agricultural land	147 (98)	94 (100)	105 (95)
Median size agricultural land (hectares)	5	2	7
Ownership of HH items			
Mobile phone	117 (78)	62 (66)	65 (59)
Radio/CD	92 (61)	60 (64)	72 (65)
Bicycle	38 (25)	25 (27)	54 (49)
Television	62 (41)	23 (24)	37 (34)
Motorcycle/scooter	23 (15)	7 (7)	21 (19)
Boat	12 (8)	0	1 (0)
Car/truck	4 (3)	1 (1)	6 (5)
Computer	6 (4)	2 (2)	3 (3)
Refrigerator	4 (3)	2 (2)	1 (0)
Animal drawn cart	0	0	3 (3)
Ownership of agricultural tools			
Panga/machete	149 (99)	88 (94)	102 (93)
Shovel	134 (89)	81 (86)	98 (89)
Axe	128 (85)	80 (85)	84 (76)
Sickle	91 (61)	76 (81)	89 (81)
Rake	51 (34)	1 (1)	9 (8)
Hammer	18 (12)	0	34 (31)
Watering can	17 (11)	0	14 (13)
Zebu plough	9 (6)	1 (1)	21 (19)
Hand hoe	0	3 (3)	0

* Wall materials purchased include concrete / cement, burnt brick, and mud brick. Collected include wood - bamboo, wood - planks, and rafia.

* Roof materials purchased include metal sheets (Iron, aluminum), and concrete / cement. Collected include wood - bamboo, thatch, and travelers palm.

* Floor materials purchased include smooth cement and tile. Collected include wood - bamboo, wood - planks, travelers palm, rafia, sand / dirt, and land.

Table A3: Livestock

Ownership of Livestock	Manantenina N (%)	Mandena N (%)	Matsobe N (%)
	N = 150	N = 94	N = 110
Poultry	147 (98)	90 (96)	88 (80)
1-3	37 (25)	39	16
4-5	19 (13)	6	8
More than 5	91 (62)	45	64
Zebu	35 (23)	18 (19)	50 (45)
1-3	31 (89)	7	38
4-5	3 (8)	6	7
More than 5	1 (3)	5	5
Pigs	25 (17)	10 (11)	26 (24)
1-3	22 (88)	9	23
4-5	2 (8)	0	1
More than 5	1 (4)	1	2
Goats	1 (1)	1 (1)	3 (3)
1-3	1 (100)	1	2
4-5	0	0	0
More than 5	0	0	1
Other*	5 (3)	0	0
1-3	5 (100)	0	0

* Other includes sheep, rabbits, and fish.

Table A4: Agricultural Activity

Variable	Manantenina N (%)	Mandena N (%)	Matsobe N (%)	All Villages N (%)
	N = 150	N = 94	N = 110	N = 354
Grew crops this past season	140 (93)	89 (95)	101 (92)	330 (93)
Crop varieties				
Rice	105 (70)	71 (80)	90 (82)	266 (75)
Vanilla	130 (87)	82 (92)	49 (45)	261 (74)
Bananas	36 (34)	44 (49)	14 (13)	94 (27)
Coffee	24 (16)	46 (52)	8 (7)	78 (22)
Coconut	29 (19)	23 (26)	0	52 (15)
Avocado	14 (9)	30 (34)	2 (2)	46 (13)
Cassava	25 (17)	8 (9)	8 (7)	41 (12)
Pineapple	14 (9)	24 (27)	1 (1)	39 (11)
Sugar Cane	12 (8)	15 (17)	10 (9)	37 (10)
Cloves	10 (7)	16 (18)	0	26 (7)
Beans	2 (1)	2 (1)	22 (20)	26 (7)
Breadfruit	3 (2)	20 (22)	0	23 (6)
Oranges	10 (7)	11 (12)	0	21 (6)
Vegetables	10 (7)	0	5 (5)	15 (4)
Cocoa	6 (4)	9 (10)	0	15 (4)
Lychee	12 (8)	2 (2)	0	14 (4)

Groundnuts / Peanuts	3 (2)	5 (6)	4 (4)	12 (3)
Maize / Corn	9 (6)	0	1 (1)	10 (3)
Ginger	8 (5)	1 (1)	1 (1)	10 (3)
Tomato	2 (1)	0	5 (5)	7 (2)
Lemons and limes	5 (3)	0	1 (1)	6 (2)
Jack Fruit	5 (3)	0	0	5 (1)
Cucumber	3 (2)	2 (2)	0	5 (1)
Mangoes	4 (3)	0	0	4 (1)
Eggplant	4 (3)	0	0	4 (1)
Cola	0	3 (3)	0	3 (1)
Taro	2 (1)	0	0	2 (<1)
Carrots	2 (1)	0	0	2 (<1)
Onions	2 (1)	0	0	2 (<1)
Chilies	1 (.6)	0	0	1 (<1)
Grapefruit	1 (.6)	0	0	1 (<1)
Lettuce and chicory	1 (.6)	0	0	1 (<1)
Shallots	1 (.6)	0	0	1 (<1)
Sweet Potatoes	0	1 (1)	0	1 (<1)
Sahano	0	1 (1)	0	1 (<1)
Katy	0	1 (1)	0	1 (<1)

Variable	Manantenina N (%)	Mandena N (%)	Matsobe N (%)
	N = 150	N = 94	N = 110
Grew only paddy rice	59 (56)	56 (78)	68 (76)
Grew only hillside rice	18 (17)	2 (3)	9 (10)
Grew both paddy and hillside rice	28 (27)	14 (19)	13 (14)
Median amount of rice planted in paddy (kg)	22.5	-	75
Median amount of rice planted in hillside (kg)	22.5	-	30
Median rice harvested (kg)	300	456	900
Median rice lost (kg)	45	75	32
Cause of rice loss			
Consumed by animals	48 (89)	14 (67)	5 (63)
Rotting	6 (11)	0	3 (37)
Cyclone	0	6 (28)	0
Theft	0	1 (5)	0

* Animals include rodents, birds, insects, and zebu.

Table A6: Vanilla Production

Variable	Manantenina N (%) N = 150	Mandena N (%) N = 94	Matsobe N (%) N = 110
Median size of agricultural land for vanilla (hectares)	2	-	2
Median vanilla harvested (kg)	20	10	20
Median vanilla lost (kg)	5	20	8
Cause of vanilla loss			
Consumed by animals	25 (62)	1 (3)	0
Theft	9 (22)	26 (76)	13 (100)
Rotting	5 (12)	0	0
Cyclone	1 (3)	7 (21)	0
Vanilla theft is a big problem	124 (95)	-	38 (78)
Type of land vanilla grown on			
Secondary growth 4 years after slash and burn	108 (77)	-	39 (80)
Slash and burn this year	11 (8)	-	4 (8)
Secondary growth the year after slash and burn	5 (4)	-	5 (10)
Forest fragments	4 (3)	-	0
Flat land near the village	1 (1)	-	1 (2)
Type of tree vanilla is grown on			
Trees you planted for vanilla	93 (72)	75 (91)	48 (98)
Trees that were already growing on the land	22 (17)	0	1 (2)
Trees you planted as cash crops	15 (12)	0	0
Coffee trees planted over a decade ago	0	1 (1)	0
New trees and some planted for vanilla a long time ago	0	1 (1)	0
Trees planted a decade ago	0	6 (7)	0
Age of trees planted for growing vanilla			
1 Year Old	12 (13)	-	7 (15)
2 - 4 Years Old	42 (46)	-	15 (32)
5-10 Years Old	17 (18)	-	10 (21)
>10 Years Old	21 (23)	-	15 (32)
Vanilla sold to			
Certification program	66 (57)	-	1 (3)
Open market in the village	24 (21)	-	16 (55)
Vanilla collector in village not pre-arranged	9 (8)	-	12 (41)
Directly to a buyer in the city	3 (3)	-	0
Did not sell	13 (11)	-	0
Belong to a certification program*	79 (61)	36 (44)	3 (6)
Symrise	58 (73)	18 (50)	0
Tsara Kalitao	19 (24)	17 (47)	0
Vanilla Mad	2 (3)	0	0
Fanambe	0	0	2 (66)
Kainzara	0	0	1 (34)
GPAS	0	1 (3)	0

* Some people belonged to more than one certification program

Table A7: Food Insecurity

Variable	Manantenina N (%)	Mandena N (%)	Matsobe N (%)
	N = 150	N = 94	N = 110
Households experienced food insecurity in past three years	104 (69)	72 (77)	75 (68)
Primary cause of food insecurity			
Inadequate HH food stocks due to small land size	54 (53)	41 (57)	49 (64)
Inadequate HH food stocks due to crop pest damage	8 (8)	0	5 (6)
Lack of money	8 (8)	0	0
Inadequate HH food stocks due to drought / poor rains	7 (7)	17 (24)	6 (8)
Old age / illness / cannot work in field	11 (11)	2 (3)	3 (3)
Does not grow rice	6 (6)	0	0
Inadequate HH food stocks due to farm inputs	2 (2)	2 (3)	3 (4)
Food expensive in the market	2 (2)	0	9 (12)
Cyclone	0	5 (7)	1 (1)
Other*	3 (3)	4 (5)	3 (4)

*Primary cause of food insecurity other Manantenina includes: too many mouths to feed, and no partner. Other Matsobe includes do not have enough food. Other Mandena includes climate change, lack of employment, lack of time to farm, and theft.

Table A8: Health and Environment

Variable	Manantenina N (%)	Mandena N (%)	Matsobe N (%)
	N = 150	N = 94	N = 110
Health insurance coverage	77 (51)	39 (41)	0
Health insurance paid for by			
Vanilla certification program	57 (73)	-	0
Save The Children	10 (13)	-	0
Mahavelona Association	6 (8)	-	0
Beton Association	2 (3)	-	0
Mahavejny	1 (1)	-	0
Main water source			
Spring / river	144 (96)	94 (100)	22 (20)
Piped	6 (4)	0	43 (39)
Open well	0	0	45 (41)
Action taken to make drinking water safer			
Boil	7 (80)	43 (98)	3 (75)
Add bleach / chlorine	2 (20)	1 (2)	1 (25)
Wash hands with soap	84 (56)	-	38 (35)
Wash hands with water only	66 (44)	-	72 (65)
Toilet facility			
Pit latrine*	149 (99)	93 (100)	103 (93)
No facility	1 (1)	0	7 (6)
Households fuel type			
Collected fuelwood	129 (86)	91 (97)	72 (65)
Charcoal	16 (10)	2 (2)	15 (14)
Purchased fuelwood	3 (2)	1 (1)	23 (21)
Gas/propane	1 (1)	0	0
Kerosene	1 (1)	0	0

Mean bundles of firewood collected weekly

3.95

3

3

* Pit latrine includes improved pit latrine, and composting toilet.

Table A9: Gender Differences

Variable	Manantenina		Mandena		Matsobe	
	Male N = 74	Male N = 41	Male N = 41	Female N = 62	Male N = 48	Female N = 62
Age (mean)	40.31	46.71	46.71	44.16	44.08	44.16
Relationship to head of household						
Head of household	72 (98)	34 (45)	40 (98)	48 (92)	46 (96)	28 (45)
Spouse	1 (1)	40 (53)	1 (2)	4 (8)	1 (2)	28 (45)
Son / Daughter	1 (1)	1 (1)	0	0	1 (2)	3 (5)
Other Relative	0	1 (1)	0	0	0	3 (5)
Attended School	73 (99)	65 (86)	36 (88)	43 (81)	45 (94)	57 (92)
Primary	29 (40)	40 (62)	23 (64)	20 (47)	28 (62)	30 (53)
Secondary	28 (38)	23 (35)	8 (22)	21 (49)	15 (33)	21 (37)
Higher	16 (22)	2 (3)	2 (6)	2 (4)	2 (4)	6 (10)
HH Main Activity						
Crop farming	60 (81)	67 (88)	36 (88)	48 (90)	40 (85)	47 (77)
Mixed farming	5 (7)	3 (4)	0	2 (4)	3 (7)	3 (5)
Teacher	3 (4)	1 (1)	0	0	2 (4)	0
Works at the shop	0	2 (3)	0	0	0	7 (11)
Other**	6 (8)	3 (4)	5 (12)	3 (6)	2 (4)	4 (7)
Owens mobile phone	60 (81)	57 (75)	27 (66)	35 (66)	31 (65)	34 (55)
Uses mobile banking	22 (30)	28 (37)	-	-	10 (21)	15 (24)
Households experienced food insecurity in past three years	55 (74)	49 (64)	32 (78)	40 (75)	36 (75)	39 (63)
Health insurance coverage	34 (46)	43 (57)	18 (44)	21 (40)	0	0
Member of a vanilla certification program	36 (49)	43 (57)	14 (34)	23 (43)	2 (4)	1 (2)

** Other Manantenina male includes working at Marojejy reception, hairdresser, mechanic, secretary for Mayor, photographer, and vanilla buyer. For females other includes housewife, tailor, and retired. Other Matsobe male includes pastor and unemployed. Matsobe female includes community health worker, student, wage labor and salaried work, and unemployed. Other Mandena male includes self-employed, wage and salaried work, and unemployed. Other Mandena female includes self-employed and unemployed.