Resilience to Climate Change (RCC) in Ethiopia Survey – 2023

Second Round RCC Survey Report

University of Copenhagen Development Economics Research Group (UCPH-DERG), Denmark, and Policy Studies Institute (PSI), Ethiopia

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Acronyms and Abbreviations

AGP	Agricultural Growth Programme
CAPI	Computer Assisted Personal Interviewing
DAP	Di-ammonium Phosphate
DERG	Development Economics Research Group
DFC	Danida Fellowship Centre
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization
HDDS	Household Dietary Diversity Score
IVR	Interactive Voice Response
KI	Key Informant
PI	Principal Investigator
PSI	Policy Studies Institute
PSNP	Productive Safety Net Programme
RCC	Resilience to Climate Change
SI	Simpson Index
SLMP	Sustainable Land Management Programme
SMS	Short Messaging Service
SNNP	Southern Nations, Nationalities and Peoples
UCPH	University of Copenhagen

Foreword and Acknowledgements

This study is a key output of the research and capacity-building project entitled 'Building Resilience to Climate Change in Ethiopia', supported financially by the Ministry of Foreign Affairs of Denmark (Danida). This activity began in April 2019 as a collaborative effort between the University of Copenhagen Development Economics Research Group (UCPH-DERG) and the Policy Studies Institute (PSI) of the Ethiopian Government.

The research project's overall objective is to identify, evaluate, and compare the drivers of resilience to climate change in rural Ethiopia using existing national survey data, satellite measures of drought exposure, and vegetation resilience, and undertaking a targeted rural household survey. This 2023 second round survey is the topic of this report. The report provides an introduction to the survey and our descriptive results, which are updated in this second round from the extensive database collected.

The survey design was first completed in 2020. The first survey round was conducted in the field during 2021 and covered 2,000 households and 40 Woredas drawn from five regional states (Amhara, Oromia, Somali, Gambela and Southern Nations, Nationalities and Peoples (SNNP)) and one City administration (Dire Dawa). The contents of the second round of the RCC Survey, carried out with a questionnaire updated for 2023 are similar to the first round and include questions on household characteristics, agricultural production and technologies, engagement in non-farm activities/enterprises, consumption, and coping strategies and resilience capacities.

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This report is dedicated to Dr Hailemariam Teklewold, who passed away on August 2, 2023. We miss his professional dedication and expertise as well as his kind and humble personality. May his soul rest in peace.

The Research Team
Copenhagen and Addis Ababa,
14 September 2023

SUMMARY

Climate-induced hazards, such as droughts, pose a major threat to the livelihoods of rural households in Ethiopia. There is an urgent need to adapt to climate change and ensure increased agricultural productivity for a population that is highly dependent on agriculture. In the past, Ethiopia experienced numerous severe drought episodes, which led to widespread famines. The climate-induced threats to Ethiopian households present significant challenges for livelihoods and agricultural production, potentially leading to further famines and humanitarian crises. Therefore, it is crucial to shield the economy from severe adverse climate impacts, build resilience, and reduce vulnerability to climate change-induced shocks by adopting effective policies.

The Resilience to Climate Change (RCC) household survey's second round consists of interviews with 1,995 households in 40 Woredas across three agro-ecological zones in five regional states: Amhara, Oromia, Somali, Gambela, and the Southern Nations, Nationalities, and Peoples (SNNP), as well as one town. We also designed the survey to provide an assessment of the contributions of the three major national flagship programs: Productive Safety Net Programme (PSNP), Sustainable Land Management Programme (SLMP), and Agricultural Growth Programme (AGP). The second round of the RCC Survey questionnaire includes questions on household characteristics, agricultural production and technologies, engagement in non-farm activities/enterprises, consumption, coping strategies, and resilience capacities.

In terms of demographic household characteristics, approximately 80 percent of the household heads were male and 50 percent were illiterate, with fewer than 10 percent having completed education beyond secondary school or an adult literacy program. Notably, from the first to the second survey round, there was a rise in the percentage of household heads and members with education levels surpassing primary school. Simultaneously, there has been a reduction in the percentage of illiterate household heads and members.

Studies have shown that increased productivity often enhances resilience to climate variability, making it a crucial strategy in adapting to anticipated climate changes in the future. However, in both 2021 and 2023, approximately 23 percent of households in the study did not adopt any

of the yield-enhancing intensification practices. This is quite a large figure that requires the attention of policy makers. Overall, the low adoption rate of improved farm technologies in Ethiopia is attributed to a number of interacting factors including limited availability of high yielding varieties suitable for farmers' needs, skyrocketing cost of essential inputs, high variability of crop yields, low quality of inputs, erratic and insufficient rainfall conditions, and limited access to credits. The findings also reveal that an integrated adaptation of combination of modern technologies (i.e., fertilizer, improved seed, agrochemicals, and irrigation together) could increase income of households through productivity gain.

In the study areas, the percentage of tree grower households, number of trees grown, and revenue generated from trees in 2023 are statistically significantly higher compared with the year 2021. This may indicate the important role of integrating trees and permanent crops with annual crop production to provide shade, a steady supply of food and/or income throughout the year, arrest degradation, maintain soil fertility, diversify income sources, enhance the efficient use of soil nutrients, water, and radiation, and provide regular employment.

While the Ethiopian government promotes irrigation use among smallholder farmers, the data reveals a contrasting trend. The number of households employing irrigation dropped from 295 in 2021 to 258 in 2023, equivalent to a decline of roughly 12.5 percent. In a related observation, we find that the proportion of individuals who received training on irrigation rose from 13.7 percent in 2021 to 17.4 percent in 2023, signifying a positive shift. Another notable coping mechanism is the sale of livestock to mitigate drought effects. In 2023, about 57.8 percent of livestock owners claim to have sold livestock. This figure is marginally higher than the 55 percent of households that did the same in 2021.

Over the span of both surveys, farm households employed the use of modern agricultural technology such as fertilizer, modern seed varieties, and pest and disease control. Encouragingly, there was an increase in the number of households claiming to use pest and disease control services perhaps partly due to climate change concerns. Additionally, more households engaged with extension services to adopt sustainable agricultural and water-management practices, highlighting the growing significance of these services in climate change adaptation.

In the sample, 30 percent were engaged in off-farm activities. This represents an increase in participation compared to the first survey conducted in 2021, where only 25 percent of households participated in these activities. Notably, off-farm enterprises operating for just one month increased from 1.4 percent to 2.6 percent. In contrast, those in operation for four months dropped from 8.8 percent to 6.7 percent during the second survey. There was a notable surge in the number of households providing transport services, rising from 19 to 57 households between the survey rounds. This suggests that transport services, especially using motorcycles and Bajajs, are becoming more profitable ventures in rural Ethiopia.

With regard to dietary habits, despite the fact that there was a general increase in the average number of food groups consumed by households, there are variations in specific food categories. The percentage of households consuming at least one food item from a food group increased for pulses, and meat and fish, while it decreased for oilseeds, and tubers and stems. Analysing dietary intake by program Woreda, between 2021 and 2023 reveals that calorie and protein intake increased for households in PSNP Woredas. Concurrently, AGP Woredas saw a rise in protein intake. In terms of household expenditure, the annual average household expenditure percentages for both food and non-food items, based on 16 expenditure categories, show that the spending patterns are largely consistent between the survey rounds.

For drought experience, comparing the results of whether households had encountered drought in the past 5 years across survey rounds indicate that in the second round, there is a slight increase in the reported incidence of drought. In the first round, a majority, 53 percent of the households, stated that they faced drought only once in the past five years. In contrast, 29 percent experienced it twice and 15 percent thrice. A smaller fraction, constituting 4 percent of respondent households, reported facing drought four or five times within that timeframe. That pattern has not changed much in the second round. Crop loss was reported as the most frequently reported impact of drought followed by livestock loss in both survey rounds. However, over the two survey rounds, there was an increase in the percentage of households who reported crop loss and a decrease in the percentage that reported livestock loss. Other impacts of drought were livestock migration, livestock disease, and family migration which were reported by a negligible share of households and there was no statistically significant change in these shares over time.

Looking at the households' coping strategies and resilience capacities in the face of climate change-induced shocks such as droughts, around 32 percent of sample respondents believe they would likely recover within six months from a setback, compared to 57 percent who feel they would not. Although the majority remains pessimistic about recovery, optimism has grown since the RCC survey 2021, where 67 percent felt recovery was unlikely.

Interestingly, households perceive an increased likelihood of recovering from drought damage within six months. This increase is seen regardless of whether households had experienced no droughts, only one drought, or more than one drought in the last five years, but it was especially strong among those who have faced multiple droughts over the last five years.

At the same time, there is a growing propensity among individuals to rely on, or become more dependent upon, family or friends when confronted with drought conditions. Those households in the sample likely to rely on family increased from 28 percent to 36 percent, and the proportion of those stating they are unlikely to lean on family or friends dropped from 47 to 42 percent.

When comparing with the first RCC Survey in 2021, fewer respondents in 2023 (53 percent down from 56 percent) feel they had not learned from previous drought experiences. Between the two survey rounds, the proportion of respondents agreeing to the statement that they had learned important lessons and are more prepared increased from 22 percent to about 29 percent. Thus, more respondents feel that they learned from past droughts and are now more prepared for future ones. This suggests a growing sentiment of learning and an enhanced anticipatory resilience capacity.

Furthermore, the proportion of households willing to shift their income sources or livelihoods in the face of a drought has grown from 19 percent in the previous survey to 26 percent in 2023. The percentage of households where a member had participated in a government program remained roughly the same or even decreased compared to the first survey round. We observe an increase in the proportion of respondents who indicate they would likely change their way of life in response to a drought-induced threat across all education level groups. In summary, households are still unlikely to change their primary source of income, way of life, or livelihood

farming system to adapt to future drought-induced threats. This suggests that the transformative capacity of households in the sample remains at a relatively low level, despite some increasing tendencies of considering alternatives.

CHAPTER 1: INTRODUCTION

1.1 Background to the project

With an estimated rural population of over 85 million, the majority of whom depend on agriculture for their livelihood, Ethiopia faces pressing development challenges. They include the need to adapt to climate change, achieve sustainable increases in agricultural productivity and production, and improve general welfare. In light of this, the University of Copenhagen Development Economics Research Group (UCPH-DERG) and the Policy Studies Institute (PSI) of the Ethiopian Government have entered into a partnership agreement. They conduct a five-year research project from April 2019 to March 2024, entitled "Building Resilience to Climate Change in Ethiopia: Policy Options for Action." This project is funded by Danida and administered by the Danida Fellowship Centre (DFC).

1.2 Objective of Resilience to Climate Change (RCC) survey[1]

Despite the rising incidence of climate-related shocks and hazards, few studies focus on resilience building through improved agricultural water management, introduction of innovative production technologies, and promotion of proactive measures over reactive ones. Additionally, there is a need to support building the capacity of households to withstand shocks and to scale up innovative practices that households use to cope with climate change. These are areas that demand an in-depth understanding of conditions at the grassroots level.

Consequently, the overall objective of the RCC research project is to identify drivers of resilience to climate change in rural Ethiopia, as well as to assess changes in socio-economic factors, production methods, and coping strategies that occurred between the 2023 and 2021

[1] This follow-up survey (i.e., end line survey) of the baseline which was held early 2021

surveys. In accomplishing this, we utilized extensively existing national survey data and satellite measures of drought exposure and vegetation resilience. We also conducted a targeted household survey focused on resilience-enhancing actions. Our analysis covered: (1) actions at both household and district/village levels; (2) the impact of large-scale interventions, including flagship programs such as the Ethiopian Productive Safety Net Programme (PSNP), Sustainable Land Management Programme (SLMP), and Agricultural Growth Programme (AGP); and (3) the roles played by institutional factors and social networks. Overall, the project aims to provide a robust evidence base to inform the design of future policies, both in Ethiopia and beyond.

1.3 Survey design and implementation

1.3.1 Sample size and coverage

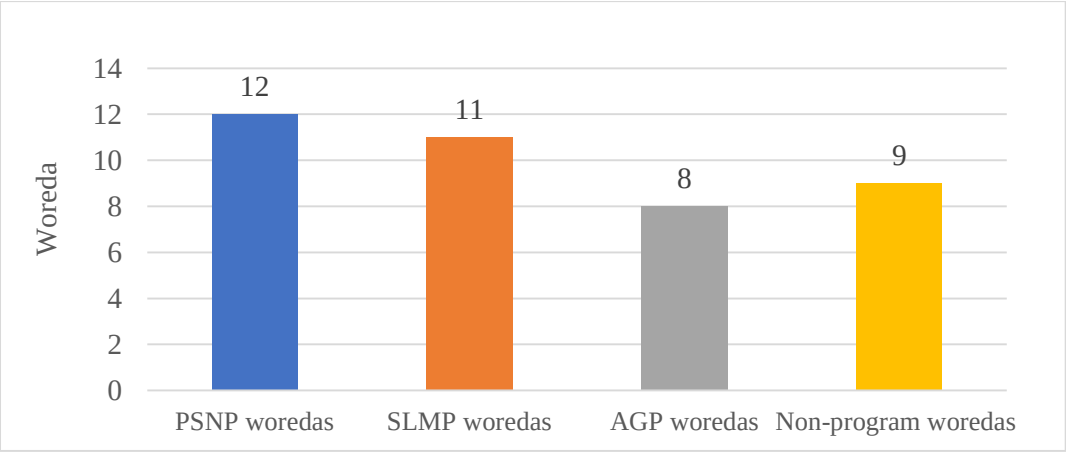
The survey covered 40 Woredas selected from five regional states: Amhara, Oromia, Somali, Gambela, and the Southern Nations, Nationalities and Peoples (SNNP), as well as the Dire Dawa City administration. Of these Woredas, 31 were involved in flagship programmes, while the other nine were from non-programme Woredas. Employing a systematic random sampling method, we chose 50 households from each Woreda (refer to Table 1.1).

Table 1.0. Distribution of Woredas and households, by region

Region	No. of Woredas	No. of Kebeles	No. of HHs
Amhara	11	33	550
Oromia	11	33	545
SNNP	13	39	650
Somali	2	6	100
Gambela	2	6	100
Dire Dawa City	1	3	50
Total	40	120	1,995

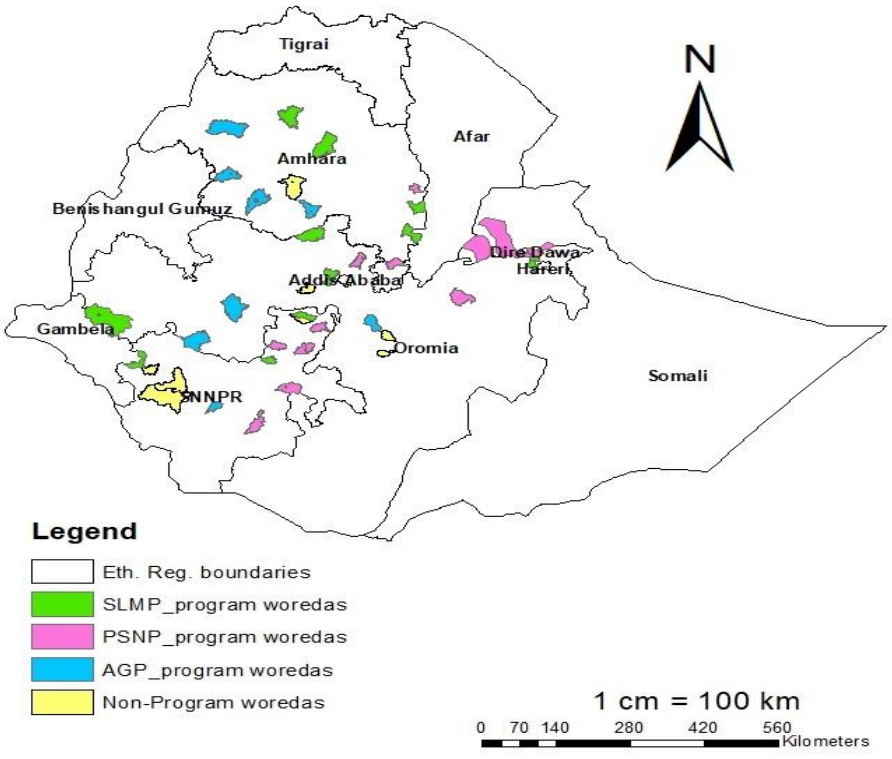
Source: Own computation based on RCC Survey 2023

Figure 1.1. Number of Woredas, by programme and non-programme



Source: Own computation based on RCC Survey 2023

Figure 1.2. Map of sample Woredas



Source: Own computation based on RCC Survey 2021

1.3.2 Sampling frame

The sampling framework was designed to encompass the three flagship programmes (SLMP, PSNP, and AGP), which constituted 77 percent of the total Woreda sample. The remaining 23 percent, or nine out of the 40 Woredas, were non-programme areas not affiliated with any of the aforementioned flagship initiatives. Beneficiary Woreda lists for these programmes were sourced from their respective coordinating offices under the Ministry of Agriculture. Any Woredas that were inaccessible or posed security issues were excluded prior to sampling. The specific number of Woredas, as indicated in Table 1.1, was then selected randomly from the comprehensive Woreda lists.

1.3.3 Sampling strategy and selection criteria

The sampling approach prioritized the population's representativeness as a fundamental criterion. The sampling process consisted of three stages: selecting sample Woredas, sample Kebeles, and then sample households. We chose Woredas from both beneficiary (programme) and non-beneficiary (non-programme) lists. The term 'programme Woredas' denotes areas where PSNP, SLMP, and/or AGP were in effect.

Given that this survey was a follow-up, designed to track changes over two distinct periods, both supervisors and enumerators received a list of households surveyed during the baseline assessment in their respective Woredas, complete with contact details. In instances where 15 or more households were missing from the list, replacements were drawn from neighbouring households exhibiting similar socio-economic conditions.

1.3.4 Survey implementation: Survey instruments, training, pre-test, and fieldwork

Questionnaires were crafted to gather either quantitative or qualitative data from respondents, specifically households. For our study, the team developed and administered a household survey questionnaire centred around five primary sections:

1. Household roster;
2. Agricultural production, technologies, and livestock;
3. Non-farm activities;
4. Wealth and consumption;
5. Perceptions of climate change, drought, and resilience capacities

For the task, 40 enumerators and 11 supervisors underwent a week-long training on utilizing the paper-based questionnaire and the Computer Assisted Personal Interview (CAPI) method. To underpin their understanding, they engaged in mock interviews at the conclusion of each training day. Subsequently, they went to Ada'a Woreda to pilot the questionnaire. Upon completing the pilot, the team convened for a debrief, during which the questionnaire was refined based on feedback from their fieldwork. The allocation of fieldworkers across different regions is in Table 1.2.

Table 1.1. Number of enumerators and supervisors, by region

Region	No. of enumerators	No. of supervisors	Remark
Oromia and Gambela	13	4	A survey coordinator, a data manager, and a research coordinator were assigned
SNNPR	13	3	
Amhara	11	3	
Somali	3	1	
Dire Dawa	3	1	
Total	40	11	

Source: Own computation based on RCC Survey 2023

The fieldwork spanned approximately a month, during which the team engaged with 1,995 households across 40 Woredas. The survey team consisted of 40 enumerators, 11 supervisors, a survey coordinator, a data manager, and a research coordinator. The survey coordinator maintained close collaboration with the supervisors and enumerators, monitoring daily progress. A survey protocol was formulated to steer the sampling processes and associated field activities. The fieldwork was meticulously overseen by the survey manager.

Every two days, enumerators, with the support of their supervisors, synchronized the collected data with the central server under the direct oversight of the programmer. Subsequently, the programmer exported the data into STATA and CSEntry files, which were then shared with both the research and survey coordinators. This data underwent thorough cleaning, verification, and modification process, executed collaboratively by the programmer, and the survey and research coordinators.

Supervisors implemented spot checks during the interviews and also conducted reviews in the evenings to pinpoint any mistakes made by enumerators. The survey coordinator centrally supervised this error-checking process by providing a specially designed template. This template was introduced to streamline communication among the field supervisors, central coordinators, and the principal investigator of the project, facilitating this through the creation of a Telegram group.

1.4 Data processing (entry and cleaning)

Effective data management is crucial to maintaining the integrity, reliability, and accuracy of collected information. It encompasses a systematic approach to the gathering, storing, cleaning, transferring, presentation, and dissemination of data for validation and utilization.

To ensure the collection of data that is both valid and timely, the team opted to use CSEntry for the design of our CAPI (Computer Assisted Personal Interview) application integral to the survey. CSEntry is a component of the CSPro software suite tailored for data collection purposes. It is versatile, with compatibility across both Windows and Android operating systems.

The process with the CSEntry CAPI application begins by creating an encrypted version of the CAPI application, which is subsequently uploaded to a secure server - this could be CSWeb, FTP, or even Dropbox. Field staff were granted access to download and install this CAPI application directly from the cloud-based storage using their unique usernames and passwords. Importantly, this method ensured security as the application, being encrypted, was resistant to any unauthorized modifications.

In the realm of extensive field surveys, streamlined data management procedures are paramount to ensure data integrity and reliability. Employing CSEntry in our approach allowed for a seamless integration of the data collection process with subsequent data management.

Once the application was installed on the devices of field staff, they could effortlessly synchronize and, if necessary, update their data with the main server. A key feature of this workflow was the involvement of supervisors in an intermediary quality check. Using Bluetooth connections, supervisors could review the data before it was uploaded to the main server. This two-tier system ensured that data uploaded was of good quality and free from obvious errors or omissions. Furthermore, the inherent efficiency of CSPro and the encrypted CAPI application allowed for a compression of the data file size. This was particularly beneficial for field staff, as it meant that synchronizing data using mobile data became not just feasible but also efficient.

Once data were synchronized to the main server, the role of the programmer or data manager came to the forefront. Their responsibilities involved downloading the data, conducting preliminary checks, and initiating the data cleaning process. This involved the removal of incomplete entries, redundant or oversampled observations, and other extraneous data points. This process is essential as the accuracy and reliability of subsequent analyses hinge on the quality and cleanliness of the raw data. The elimination of unwanted observations is but the initial step in a comprehensive data cleaning process that aims to refine the dataset to its most useful and relevant form.

In addition to the quantitative household survey, we conducted qualitative interviews at the community level. These were conducted by supervisors. Key informants were individuals who could provide detailed information and opinions on a specific subject based on their knowledge

at the community/Kebele level. These included: (1) any Kebele committee member, (2) development agents, (3) farmers/elderly individuals, and (4) women representatives. They were all expected to possess a thorough understanding of development interventions in their community or Kebele. The checklist we used encompassed significant components of the quantitative survey, and consultative meetings were held with the above four categories of key informants. Field-level project sites were visited to assess the effectiveness of investments and the benefits to the community.

The following are some of the common challenges the field team faced when collecting data:

- Reaching out to the respondents proved difficult as the random selection technique resulted in sample households being distributed extensively.
- Due to limited transportation options, field staff sometimes spent up to four hours traveling from one household to another.
- On occasion, sample households were not located in the village due to reasons such as migration, death, or other factors.
- Transportation costs surged, especially when moving from one Woreda to another and service availability was particularly limited in remote Woredas.
- In some Kebeles, especially in the Somali region, there was a lack of organized household lists for sampling.

1.5 Structure of report

The data collected is important for a comprehensive understanding of the impacts and implications of climate change on the rural Ethiopian population. The report categorizes and discusses these findings across six chapters:

- **Chapter 1: This introductory chapter** provides readers with an overview of the project's genesis, goals, and the nature of the survey, setting the context for the subsequent chapters.
- **Chapter 2: Household Characteristics**. This chapter briefly outlines the demographics and baseline information of the surveyed households. It uncovers

patterns in family structure, age, gender distribution, and other relevant household traits.

- **Chapter 3: Agriculture, Livestock, and Irrigation**. This chapter sheds light on the varied agricultural practices, the technologies in use, livestock holdings, and the spread of non-farm activities, giving a multifaceted view of the rural economy.
- **Chapter 4**: **Non-farm Activities.** This chapter explores alternative income sources of the surveyed households.
- **Chapter 5: Consumption**. This chapter provides insights into the economic well-being of the surveyed households, with a focus on food consumption.
- **Chapter 6: Drought Exposure and Resilience Capacity.** At the heart of the project is the urgent need to understand climate change's impacts. This chapter describes households' experiences with drought, their perceptions of climate change, and their capacity to adapt and bounce back from such adverse events.
- **Chapter 7: Conclusion**. This chapter summarizes the second round of the RCC Survey, highlighting main insights and policy recommendations.

CHAPTER 2: HOUSEHOLD CHARACTERISTICS: DEMOGRAPHY, EDUCATION AND OCCUPATION

2.1 Household characteristics

This chapter provides summary statistics on household demography, education, and occupation. Drawing from the 2023 sample of 1,995 households interviewed in the study, Table 2.1 showcases several key characteristics of the sample households. The average household size stands at 6.9 persons. The average number of children under 5 years of age is 0.6, with a range from 0 to 5, and the average number of household members aged over 59 years is 0.2, ranging from 0 to 3.

The average age of household heads is 47.5 years, which is slightly higher than in 2021, where the average age was 46 years. Around 20 percent of the households were headed by females, and approximately 90 percent of the household heads identified agriculture as their occupation. In comparison to the 2021 RCC survey, these numbers are roughly consistent: 18 percent of the households were female-headed, and 95 percent cited agriculture as their occupation.

Examining the education levels of household heads, 50 percent are illiterate, mirroring the figures from 2021. Fewer than 10 percent have completed education beyond secondary level or participated in an adult literacy program.

Table 2.1. Household characteristics

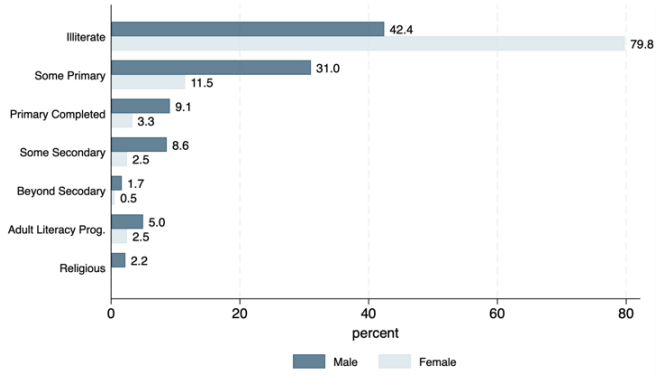
	Mean	Std. dev.	Min	Max
Household size and composition				
Household size	6.9	2.36	1	18
No. of children <5	0.6	0.76	0	5
No. of elderly +60	0.2	0.50	0	3
Household head characteristics				
Age	47.5	14.2	22	85
Female	0.2	0.4	0	1
Household head education and occupation				
Illiterate	46 %	0.5		
Beyond secondary	1.3%	0.1		
Adult literacy programme	6.3%	0.2		
Occupation: agriculture	90%	0.2		

Observations	1995

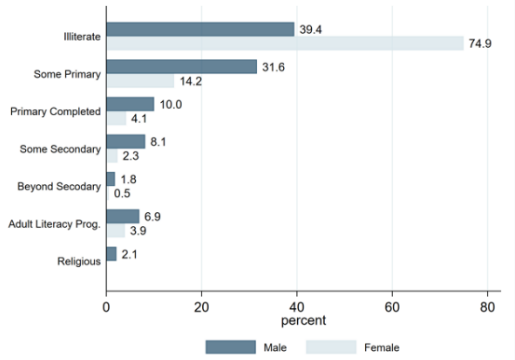
Source: Own computation based on RCC Survey 2023

In Figures 2.1 and 2.2, the distribution of education levels by gender is illustrated for both the RCC Survey 2021 and 2023. Between the two surveys, there has been a decrease in the percentage of household heads, both male and female, who are illiterate. Additionally, there is a slight increase in the percentages of household heads who have completed some primary, primary, or participated in an adult literacy program. This suggests that household heads exhibited a higher educational level in the second survey round.

Figure 2.1. Education level of household head, by gender



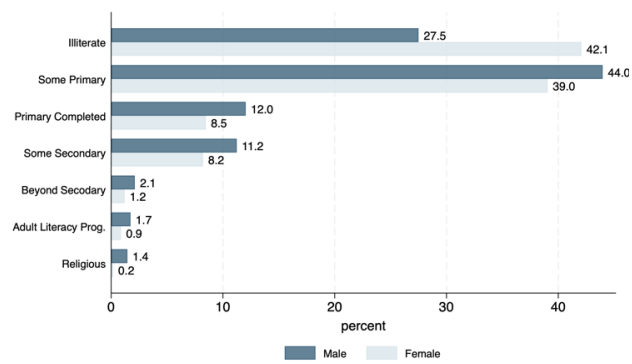
Source: Own Computation based on RCC Survey 2021



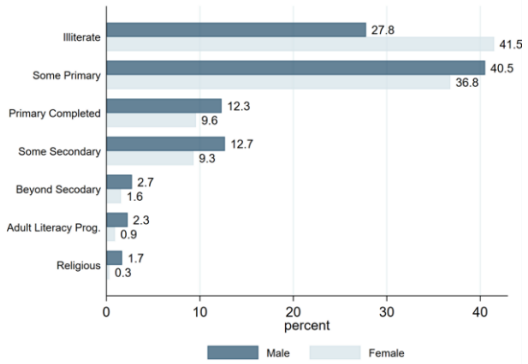
Source: Own Computation based on RCC Survey 2023

Figure 2.1 shows the education levels of the household members by gender. Between the years, the percentage of household members having completed primary, some secondary, beyond secondary education, and adult literacy programme, has increased. At the same time, the percentage of household members being illiterate has decreased, though only slightly.

Figure 2.2. Education level of household members, by gender



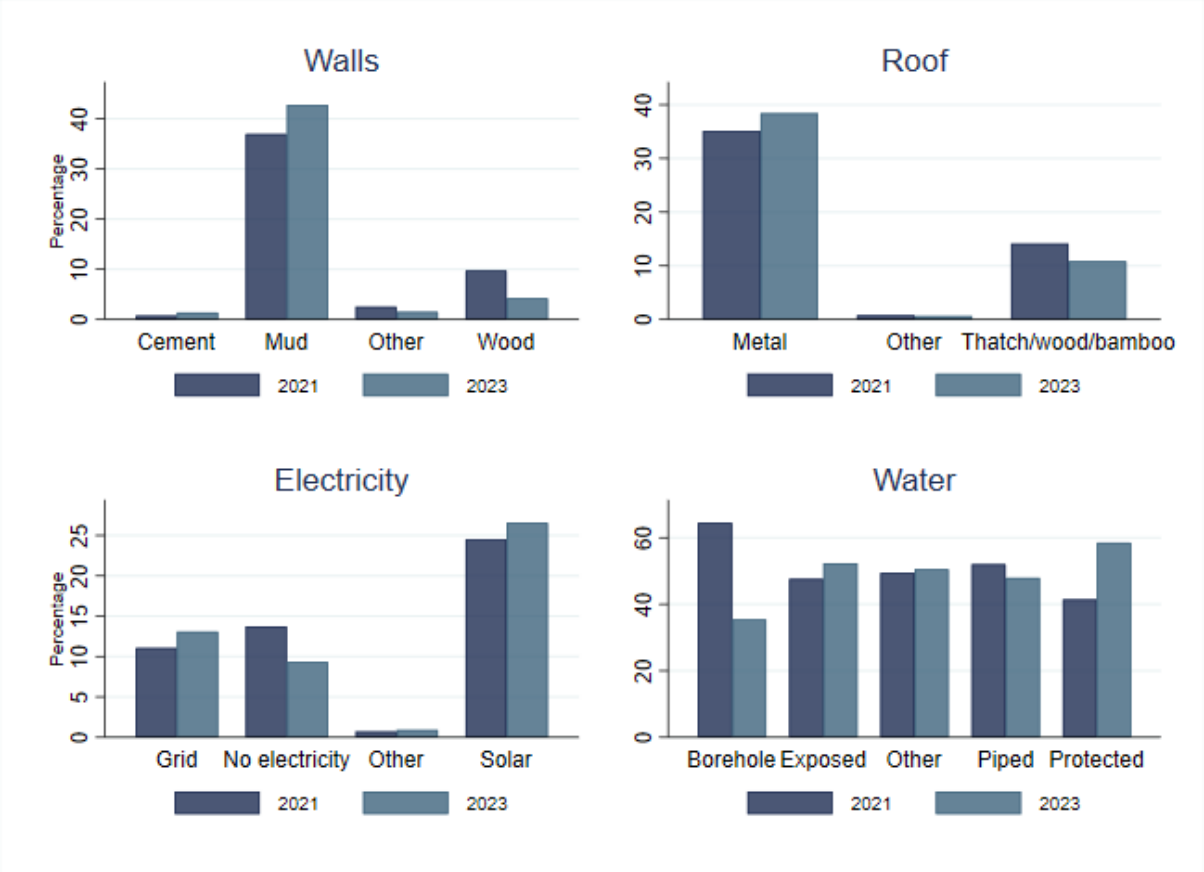
Source: Own Computation based on RCC Survey 2021



Source: Own Computation based on RCC Survey 2023

In Figure 2.3, the housing properties, as well as sources of water and energy of the sampled households, are broken down by survey rounds. Regarding housing materials for walls and roofs, a larger proportion of households in 2023 has walls made of mud and/or roofs made of metal compared to the first survey in 2021. Conversely, the percentage of households with walls or roofs constructed from wood has seen a decline between the two survey rounds.

Figure 2.3. Households' housing material and source of water and energy, by year



Source: Own Computation based on RCC Survey 2023

Moreover, we can see that in the sample, the source of electricity is increasingly coming from solar power or connections through the available grid. Another change between the survey rounds has been the decrease in households in the sample that report having no electricity. The percentage of households that report sourcing their water from unprotected and protected sources has increased between the survey years. This is both a positive and negative development since increased usage of protected water sources means more households have access to safe and uncontaminated water, while increased usage of unprotected water sources means more unsafe and contaminated water access. At the same time, there has been a decrease in households that source their water from boreholes/tube wells and piped water.

CHAPTER 3: AGRICULTURAL PRODUCTION AND TECHNOLOGIES

3.1 Farming systems, land certification and farm characteristics

With an overwhelmingly agrarian economy, crop production and livestock keeping are inevitably the two most important activities that characterize the different farming systems. The descriptive statistics indicate that the mixed farming system, where both crop and livestock production are integrated, is the dominant agricultural system in the study areas. On average, more than 88 percent of the sampled households engage in the mixed farming system.

However, the transition matrix in Table 3.1 reveals changes in the composition of crop and livestock production over time, but the extent of these changes depends on the type of farming system. We observe that out of the total number of households that engaged only in crop farming in 2021, about 39 percent continued their crop farming in 2023. Meanwhile, the majority of crop-only households (about 59 percent) shifted to the mixed farming system, and only 2 percent shifted to livestock production. However, out of the total number of households that were engaged in mixed farming systems in 2021, about 90 percent continued to practice the same mixed farming system in 2023. Only 9 percent and 1 percent of households shifted to crop farming and livestock production, respectively.

Table 3.1. Transition matrix of farming system between year 2021 and 2023 (percent of households)

	Farming system in 2023			
Farming system in 2021	Crop only	Livestock only	Mixed farming	Total (in 2021)
Crop only	39.4	1.6	59.0	9.5
Livestock only	11.1	5.6	83.3	0.9
Mixed farming	9.2	0.7	90.1	89.6
Total (in 2023)	12.1	0.9	87.1	

Source: Own computation based on RCC Survey 2021 and 2023

The average farm size of the studied households was 1.2 ha in 2021 and 1.3 ha in 2023, as shown in Table 3.2. The reported farm sizes closely align with the national landholding average of 1.06 ha per household from 2015/16. Compared to the landholding in 2021, we observed a statistically significant increase in average landholdings in 2023 in the Somali and Gambela regional states. Although the average landholding increase across all study regions was only 7 percent, the percentage change in average farm size was notably higher in Gambela (with an increase of about 46 percent) and Somali (with an increase of about 19 percent) regions. In both years, the majority of the total farmlands (approximately 85 percent of them) was obtained through usufruct rights from the government, as noted in Table 3.2. The remaining 15 percent of farmlands was acquired through various rural land tenure arrangements such as share-in, rent-in, etc., from other individual farm households.

Ethiopia is widely recognized for implementing one of the most cost-effective land registration systems to document landholdings, with the aim of enhancing tenure security, and address issues arising from the absence of a land certification system. In addition to the land certification initiative that began in the late 1990s and early 2000s, which was reliant on a paper-based land-use certificate, a second phase employing geographic information system (GIS) technology has also been introduced. In this survey, our focus is on examining the extent of certification among farmer landholdings. The data revealed that about 67 percent of the farmers possess certificates for all their holdings, while 21 percent and 12 percent of the farmers either have no certificates or only have certificates for some of their holdings, respectively, as reflected in Table 3.2. The proportion of farm households that have land certificates for all their holdings has risen by approximately 20 percent during the period between the survey rounds. This increase is counterbalanced by a decline in the proportion of farm households without certificates for any of their holdings (around 36 percent), and those that possess certificates only for a portion of their holdings (about 48 percent).

Table 3.2. Change in land holding and certification by year

Variables	2021 Mean	2021 Std. Dev	2023 Mean	2023 Std. Dev.	Difference (2023 over 2021)
Total farm land, ha	1.20	1.15	1.28	1.32	0.085**
Amhara	1.07	0.03	1.11	0.03	0.035
Oromia	1.53	0.06	1.58	0.07	0.044
Somali	1.81	0.14	2.14	0.21	0.335*
SNNPRG	0.98	0.05	1.06	0.05	0.077
Gambela	1.11	0.10	1.61	0.15	0.506***
Dire Dawa	0.66	0.11	0.63	0.11	-0.030
Share of own land (%)	85.59	0.01	84.57	0.01	-1.020
Land certificate for all holdings (%)	67.05	0.47	80.40	0.38	13.35***
Land certificate for some holdings (%)	12.15	0.33	6.32	0.24	-5.83***
No land certificate for all holdings (%)	20.80	0.41	13.28	0.34	-7.52***

Source: Own computation based on RCC Survey 2021 and 2023

On average, farm households in the study areas cultivate approximately four plots and grow three distinct types of crops. The mean plot size is about 0.57 ha, with no statistically significant variation in plot size between years, as detailed in Table 3.3. On average, each plot is roughly at a 12 minutes walking distance from the home. The plot size exhibits variation across the study areas. The average size for the smallest plots, characterized as plots less than 0.5 ha, is approximately 0.28 ha. This average plot size is statistically significantly smaller than that of the larger plots, defined as plots exceeding 0.5 ha. We also note variations in the average distance from home to the plot between the smallest and largest plots. While there is no statistically significant change in plot distance over time, we observe that the smallest plots are closer to homes compared to the largest plots. This is in line with the common wisdom that the average monitoring costs, including guarding, surveillance, and routine inspection, are greater for the largest plots compared to the smallest plots.

Land fragmentation, where a single farm household manages multiple spatially separated parcels, is a prevalent feature in Ethiopian smallholder farming systems. Using the Simpson Index (SI) for plot fragmentation, we have constructed the household land fragmentation index. This measure represents the relative significance of each plot. Thus, fragmentation is assessed

not only by the number of plots but also by its distribution. Maximum diversity is observed when the shares are uniformly distributed among the groups. The SI varies from zero to one; a higher index indicates greater farm fragmentation. The descriptive statistics revealed minor alterations in farm fragmentation indices between 2021 and 2023, as shown in Table 3.3.

We also observed that the Simpson index for farm fragmentation is higher than the crop diversification index. This finding suggests that farmers' diversification strategies encompass not just crop diversification but also spatial diversification of farmlands. Consistent with other studies, in Ethiopia, due to factors like inheritance rights, land reforms, tenure schemes, and the dynamics of land markets, there exists a small average fragmented farm size, but with a diversity in holding size (Deininger & Jin, 2006). Commodity market failures might also contribute to fragmentation. Subsistence farmers might opt to grow multiple crops for household consumption instead of buying them with cash crop sales proceeds (Blarel et al., 1992). Similarly, in the context of non-functional labour markets, where the labour supply on the farm is determined by a household's own productive capabilities, farm fragmentation allows farmers to efficiently allocate their available family labour in accordance with their seasonal labour needs (Blarel et al., 1992).

Similarly, crop diversification is a strategy that optimizes the utilization of land, water, and other resources, and mitigates risks and uncertainties arising from climatic and biological factors. The Simpson index for crop diversification computes the crop diversification index.

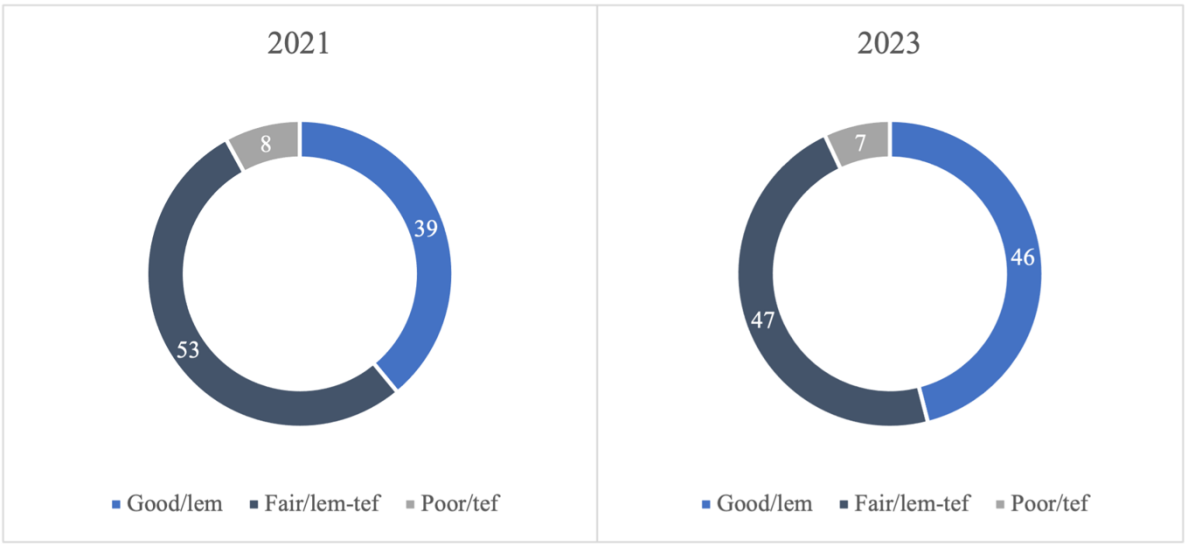
Table 3.3. Plot size, distance, fragmentation and diversification

Variables	2021		2023		2023 - 2021
	Mean	SD	Mean	SD	
Plot size, ha	0.56	0.68	0.58	0.68	0.02
Plot size of smallest plots, ha	0.28	0.12	0.27	0.12	-0.02***
Plot size of largest plots, ha	0.96	0.91	1.05	0.88	0.09**
Plot distance, minutes	11.67	15.87	12.51	17.12	0.83**
Plot distance of smallest plots, minutes	8.93	13.99	9.91	15.53	0.98
Plot distance of largest plots, minutes	15.61	17.50	16.48	18.63	0.87
Number of plots	3.76	2.30	4.05	2.47	0.29***
Number of crops	2.89	1.54	3.04	1.71	0.16***
Share of fertile land (%)	0.33	0.01	0.42	0.01	0.09***
Land fragmentation, Simpson Index	0.55	0.27	0.58	0.26	0.03***
Crop diversification, Simpson Index	0.45	0.26	0.47	0.27	0.02**

Source: Own computation based on RCC Survey 2021 and 2023

In general, we noticed an upward trend in soil fertility across the plots (Table 3.3). In 2023, approximately 42 percent of the plots were considered fertile. This figure is statistically significantly higher than the proportion of fertile plots in 2021, which stood at about 33 percent. The rise in improved soil fertility is accompanied by a decrease in the proportion of farmlands with medium and poor soil fertility.

Figure 3.1. Status of soil fertility (percentage of plots)



Source: Own computation based on RCC Survey 2021 and 2023

Given the fact that farming decisions usually involve contributions from different household members either individually or jointly, considering only the household head as the sole decision-making unit fails to recognize the role played by other household members. These members might also own resources and be responsible for decision-making. Therefore, we analyse the role of gender in intra-household resource dynamics, focusing on the ownership, management, and control of resources.

Table 3.4 indicates the gender gaps in reported land ownership, plot management, and control over output from the plot in both 2021 and 2023. While we examined plots with both jointly and individually owned, managed, and control of outputs at varying proportions within households, it seems that joint ownership, management, and control of outputs is the most common arrangement in rural Ethiopian households. Out of the total farm plots considered in

this study, more than 70 percent of the plot ownership, management decisions, and control of output were jointly made by the head and the spouse. Of the remaining plots, men's sole ownership, management, and control of outputs were still higher than individual women's. In Ethiopia, due to strong traditional gender biases, male members have more options for ownership and management of agricultural lands and control of outputs from the land. The above results suggest how studies that only consider the gender of the household head might overlook such intra-household variations in resource ownership and farming decisions.

Table 3.4. Gender disparities of land ownership, management and output control (percent)

	Year		
Variable	2021	2023	Difference
Share of land owned by:			
Men	21.88	10.60	-11.27***
Women	7.45	9.04	1.59***
Joint	70.67	80.36	9.69***
Share of land managed by:			
Men	17.01	14.73	-2.28***
Women	5.42	6.06	0.64*
Joint	77.57	79.20	1.64***
Share of output control by:			
Men	16.27	10.50	-5.76***
Women	6.37	6.75	0.38
Joint	77.36	82.75	5.39***

Source: Own computation based on RCC Survey 2021 and 2023

3.2 Agricultural technology adoption

Table 3.5 below presents the unconditional adoption rate of various agricultural practices and the transition matrix (indicating the change in adoption) between the years 2021 and 2023. While persistence in the adoption of certain practices over time was evident, there were also significant heterogeneities in adoption rates among the different practices. We observed no

change in the adoption rate of improved seeds, fertilizer, and double-cropping between 2021 and 2023. On average, about 39 percent, 71 percent, and 25 percent of households adopted improved seeds, fertilizer, and double-cropping in both 2021 and 2023, respectively. However, in comparison with the adoption rates of organic fertilizer (58 percent), agro-chemicals (46 percent), stone/soil terraces (55 percent), and crop rotation (36 percent) in 2021, the adoption rates of these practices in 2023 increased by 6 percent, 9 percent, 14 percent, and 31 percent respectively. Additionally, in 2021, the adoption rates of irrigation and inter-cropping stood at 15 percent and 23 percent, respectively. However, in 2023, these adoption rates decreased to 12 percent and 19 percent, respectively.

On the other hand, the transition matrix in Table 3.5 shows significant persistence in both adoption and non-adoption of farm technologies between the years 2021 and 2023. The percentage of farmers continuing with the adoption of these practices from 2021 to 2023 ranges from 44 percent (for irrigation) to 86 percent (for fertilizer). Conversely, the percentage of farmers continuing with non-adoption ranges from 47 percent (for stone/soil terraces) to 94 percent (for irrigation).

This means, out of the total number of adopters of irrigation and fertilizer in 2021, 44 percent and 86 percent of them, respectively, continued with the adoption of these practices in 2023. Similarly, of the total number of non-adopters of soil/stone terraces and irrigation in 2021, approximately 47 percent and 94 percent of them, respectively, remained non-adopters of these practices in 2023. These results suggest that 6 percent, 32 percent, and 53 percent of the non-adopters of irrigation, fertilizer, and soil/stone terraces in 2021, respectively, transitioned to adopting these practices in 2023. Similarly, out of the total number of adopters of irrigation, fertilizer, and stone/soil terraces in 2021, about 55 percent, 14 percent, and 29 percent of them, respectively, transitioned to dis-adoption of these practices.

Table 3.5. Transition matrix on adoption of sustainable agricultural practices in 2021 and 2023 (percent)

Practices	2021	2023		
		Non-adopter	Adopter	Total
Irrigation	Non-adopter	94.34	5.67	85.15
	Adopter	54.75	45.25	14.85
	Total	88.46	11.54	100
Improved seeds	Non-adopter	78.35	21.65	61.28
	Adopter	32.80	67.20	38.72
	Total	60.70	39.30	100
Fertilizer	Non-adopter	68.21	31.75	29.07
	Adopter	13.60	86.40	70.93
	Total	29.49	70.51	100
Agro-chemicals	Non-adopter	70.96	29.02	54.41
	Adopter	25.31	74.69	45.59
	Total	50.16	49.84	100
Organic fertilizer	Non-adopter	54.72	45.28	42.29
	Adopter	27.27	72.73	57.71
	Total	38.88	61.12	100
Crop Rotation	Non-adopter	61.83	38.17	63.64
	Adopter	35.78	64.22	36.36
	Total	52.36	47.64	100
Inter-cropping	Non-adopter	88.17	11.83	77.18
	Adopter	55.87	44.13	22.82
	Total	80.80	19.20	100
Soil/Stone terrace	Non-adopter	46.90	53.10	44.86
	Adopter	28.93	71.07	55.14
	Total	36.99	63.01	100
Double cropping	Non-adopter	88.53	11.48	74.39
	Adopter	34.91	65.09	25.61
	Total	74.80	25.20	100

Source: Own computation based on RCC Survey 2023

Table 3.6 displays the adoption rates of various sustainable agricultural practices, broken down by Woredas participating in PSNP, AGP, and SLMP versus non-program Woredas. The results reveal that the adoption rate of yield-enhancing agricultural technologies, such as improved seeds, fertilizers, agro-chemicals, and irrigation, is higher in Woredas operating under AGP when compared to non-program Woredas, as well as those under PSNP and SLMP.

One of the anticipated strategic outcomes of AGP implementation is the enhancement of agricultural production and income by raising both crop and livestock productivity and commercialization. The program asserts that boosts in crop and livestock production and productivity can be realized through the support of the availability and adoption of advanced inputs, agronomic methods, and the promotion of contemporary farming technologies. Consequently, adopting these refined technologies and practices is viewed as an intermediate outcome that has an effect on increasing both crop and livestock productivity and income within the program's domains. Conversely, the adoption rate of soil and water conservation methods, such as soil/stone terracing and organic fertilizers, is more prevalent in Woredas operating under PSNP and SLMP. One of the primary objectives of both the SLMP and PSNP is to amplify and promote the adoption of pertinent sustainable land and water management technologies and practices by smallholder farmers and communities in the chosen Woredas.

Table 3.6. Adoption rate of sustainable agricultural practices by program Woredas (percent) in 2023

	Programs			
Practices	PSNP	AGP	SLMP	Non-program
Improved seeds	35.97	57.16	21.42	47.09
Fertilizer	69.54	81.07	63.87	70.13
Agro-chemicals	41.91	63.68	42.27	46.98
Organic fertilizers	64.46	57.54	60.15	52.11
Rotation	40.02	43.09	46.93	36.72
Intercropping	27.71	19.57	19.55	14.03
Irrigation	10.93	26.47	11.82	7.18
Soil/Stone terrace	66.61	51.15	62.94	51.20
Double cropping	31.41	25.83	27.00	17.22

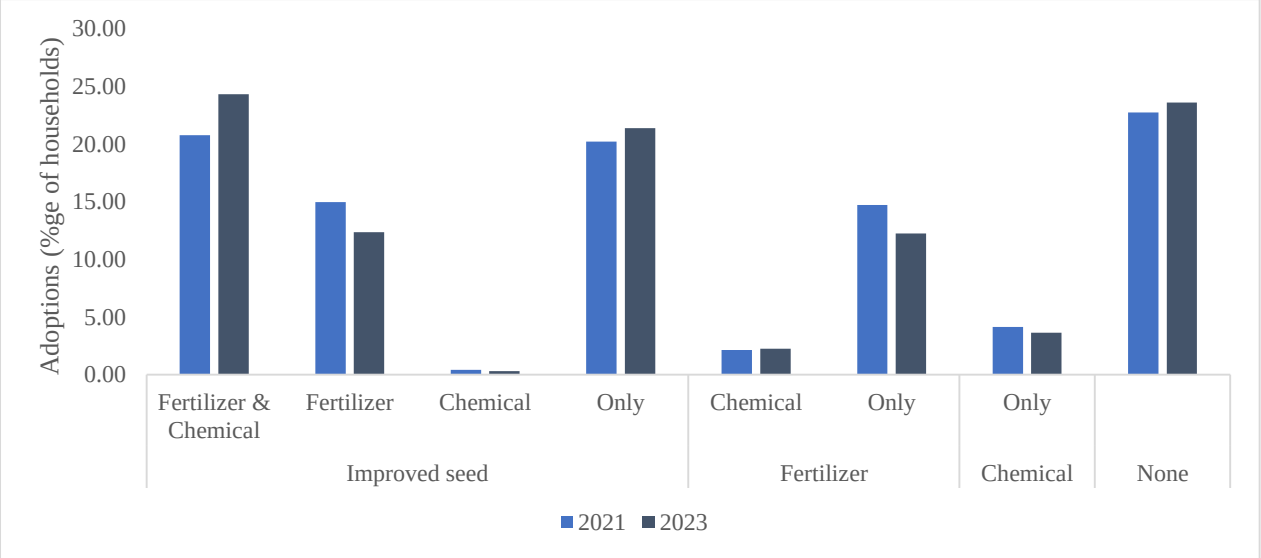
Source: Own computation based on RCC Survey 2023

Because climate change is introducing additional pressures to the already strained ecosystems where smallholder farming occurs, farmers might adopt a range of practices simultaneously in order to leverage the potential benefits of complementary, substitution, or supplementary solutions to address their overlapping challenges (Teklewold et al., 2017). We highlight the

adoption of a combination of external inputs, such as improved seeds, fertilizer, and agro-chemicals that aid in the intensification of agricultural production by smallholder farmers.

The introduction of modern crop varieties, agro-chemicals, and inorganic fertilizer has the potential to enhance food security and income for a rapidly growing population by boosting productivity. Increased productivity often enhances resilience to climate variability, making it a crucial strategy in adapting to anticipated climate changes (Bryan et al., 2011). Figure 3.2 displays the adoption rate of various combinations of technologies. In both 2021 and 2023, approximately 23 percent of households did not adopt any of these yield-enhancing intensification practices. However, the rate of joint adoption of all three technologies was 21 percent in 2021 and 24 percent in 2023. This difference in joint adoption was statistically significant. Conversely, while the adoption of fertilizer in conjunction with modern seeds and agro-chemicals increased over time, the adoption of fertilizer either on its own or combined with modern seeds decreased by around 17 percent between 2021 and 2023. The unconditional adoption rate of agro-chemicals stood at 27 percent in 2021 and 30 percent in 2023. Notably, a significant proportion of these adopters chose to employ agro-chemicals in tandem with modern seeds and fertilizer rather than adopting them partially with modern seeds and/or fertilizer or using agro-chemicals alone. The rates of adopting improved seeds or fertilizer individually are unsurprisingly lower than their combined adoption rates. These results underscore the interdependence among the three intensification practices.

Figure 3.2. Adoption of combination of modern technologies (percent)



Source: Own computation based on RCC Survey 2021 and 2023

The aforementioned statistics illustrate that the adoption status of the three intensification practices was influenced by whether these technologies were adopted individually or in conjunction with one another. However, these adoption rates did not elucidate the intensities of adoption for each of these technologies by the average households. Table 3.7 showcases the proportion of area influenced by each of these three intensification technologies.

Of the total farmland under cultivation, a mere 18 percent utilized improved crop seeds, while the remaining 82 percent employed local seeds. The proportion of land where fertilizer was applied stood at about 52 percent. The intensity of adoption for both modern seeds and fertilizer application remained statistically unchanged between 2021 and 2023. Conversely, the intensity of agro-chemical adoption witnessed a statistically significant increase, rising from 32 percent in 2021 to 36 percent in 2023. Notably, when evaluating modern seeds, which include both fresh and recycled improved seeds, the intensity of fresh seed adoption in both 2021 and 2023 exceeded the proportion of land cultivated with recycled seeds. We define fresh improved seed as a new brand of improved seed, which has not been used before. Its impact on productivity is expected to be better than previous varieties, given that the necessary conditions are met. When part of the production obtained from an improved seed is used as seed again, we call it is a recycled seed.

Table 3.7. Intensity of adoption of seeds, fertilizer and agrochemicals

Share of area covered with (%):	Year		Difference
	2021	2023	
Improved seeds	17.71	17.80	0.09
Fresh seeds	15.00	15.99	0.99
Recycled seeds	2.71	1.81	-0.90**
Local seeds	82.29	82.20	-0.09
Fertilizer	52.91	52.44	-0.47
Agro-chemicals	31.95	35.77	3.82***

Source: Own computation based on RCC Survey 2021 and 2023

The above descriptive analysis reveals that farmers may use different types of seeds in isolation or in combination. Table 3.8 shows the adoption rate of the combinations of different types of seeds. Although the majority of farmers (about 61 percent) did not adopt improved seeds (meaning they use only local seed), about 26 percent of the households in 2021 and 30 percent of households in 2023 adopted fresh modern seeds jointly with local seeds. About 4 percent of farm households adopted fresh improved seeds only, without growing any other types of seed. While the unconditional probability of adoption of recycled seeds was 8 percent in 2021 and 5 percent in 2023, the majority of these farmers used recycled seeds jointly with local seeds or together with fresh and local seeds. The adoption of recycled seeds in isolation was very low (less than 1 percent).

Table 3.8. Adoption of different type of seeds (percentage of households)

Seed combinations	Year		Difference
	2021	2023	
Fresh, Recycled and Local	4.27	2.33	-1.94***
Fresh and Recycled	0.86	0.21	-0.66***
Fresh and Local	26.40	30.27	3.88***
Recycled and Local	2.59	2.23	-0.36
Fresh only	3.20	4.04	0.84*
Recycled only	0.36	0.16	-0.20
Local only	62.31	60.76	-1.55

Source: Own computation based on RCC Survey 2021 and 2023

In general, despite the fact that the adoption of agricultural inputs such as fertilizer and improved seeds has shown a rising trend over the past decade in Ethiopia, it remains low when compared to other developing countries (Byerlee et al., 2007; Spielman et al., 2011). A number of interacting poverty and productivity traps constrain the wider use of agricultural inputs: limited availability and high cost of inputs, lack of varieties suitable for farmers' needs, low levels and high variability of crop yields, and erratic and insufficient rainfall conditions. Additionally, while other factors certainly play a role in influencing the adoption of new inputs, limited access to formal financial services (i.e. credit, saving, and insurance) and a lack of formal credit facilities are often major impediments to the adoption of improved agricultural inputs in many developing countries, including Ethiopia (Feder et al., 1985; Carter, 2013).

3.3 Technologies and farm income

The farm households produced various types of crops, including cereals, pulses, oilseeds, vegetables, root crops, spices, cash crops, and fruits during 2020. Table 3.9 presents the summary statistics on the average crop yield of harvested crops in 2021 and 2023. Although we observed substantial differences in productivity across crops, there are no statistically significant differences in crop yields between 2021 and 2023.

Table 3.9. Average yield of major crops, tons/ha

Crops category	Year		
	2021	2023	Difference
Cereals	2.56 (61.28)	2.82 (75.31)	0.29
Pulses	2.38 (39.07)	2.94 (54.18)	0.57
Oil crops	0.50 (0.53)	0.43 (0.52)	-0.07
Vegetables	4.39 (72.82)	4.58 (20.41)	0.19
Root crops	2.29 (6.3)	2.45 (29.47)	-0.16
Fruits	4.50 (29.46)	4.13 (8.39)	-0.36
Spices	1.87 (4.63)	1.78 (3.39)	-0.09
Cash crops	4.00 (64.75)	2.57 (27.25)	-1.43

Source: Own computation based on RCC Survey 2021 and 2023

Note: Numbers in parenthesis are standard deviations

We also disaggregate yields of major crops for program Woredas where PSNP, SLMP, and AGP have been operated and compare these with non-program Woredas (Table 3.10). The descriptive statistics indicate that Woredas benefiting from AGP have shown some improvements in yields of some crops such as pulses, vegetables, and fruits compared with yields obtained from non-program Woredas. AGP is a multifaceted investment program supporting agricultural productivity and commercialization, focusing on high agricultural potential areas to address some of the key constraints to agricultural growth and thereby contribute to overall economic growth and transformation. Despite this correlation, we need additional evidence from an extensive study to confirm such causality.

Table 3.10. Yield of major crops by program Woredas

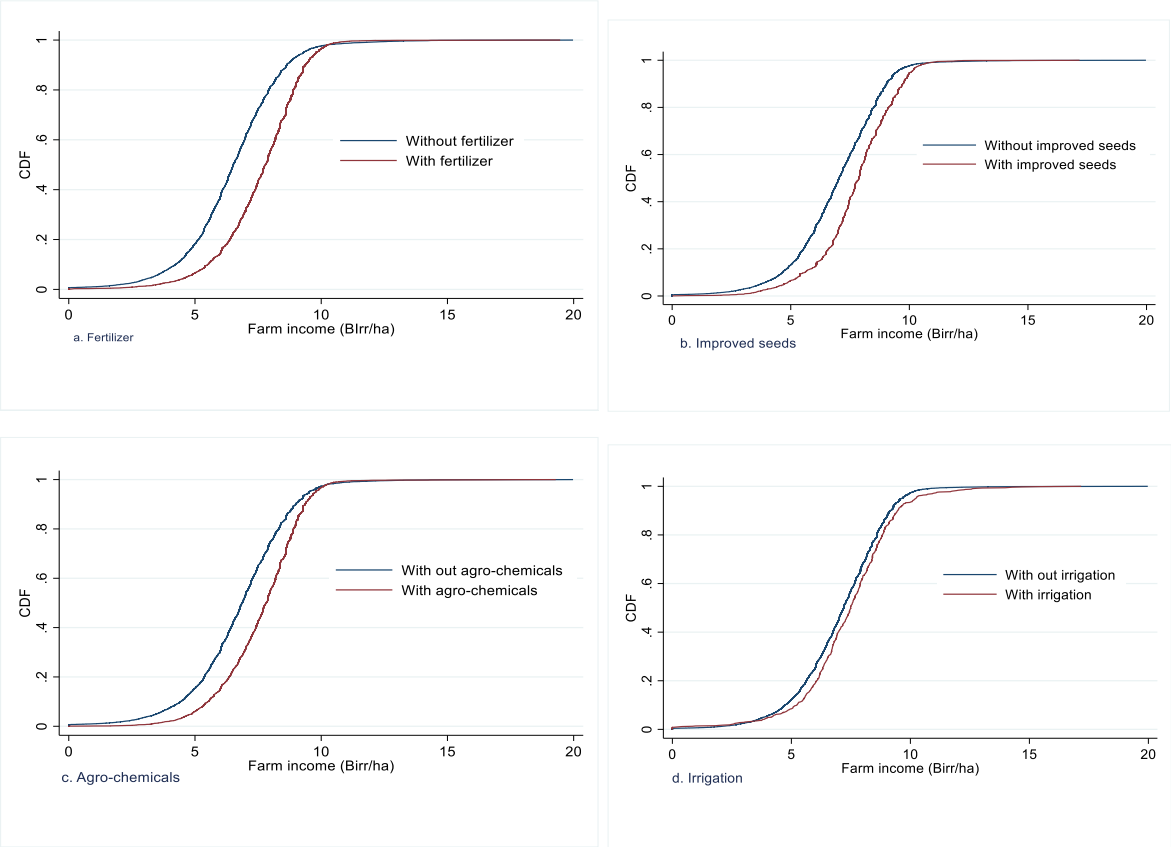
	Program			
Crop category	PSNP	AGP	SLMP	Non-program
Cereals				
Mean	1.69	3.52	1.68	3.72
Std Dev.	21.32	74.75	34.45	108.48
Pulses				
Mean	0.39	8.84	0.47	4.11
Std Dev.	1.69	95.13	0.81	58.39
Oil crops				
Mean	0.52	0.54	0.22	0.81
Std Dev.	0.48	0.55	0.23	0.73
Vegetables				
Mean	1.96	7.50	3.87	3.14
Std Dev.	6.09	88.97	26.47	4.62
Root crops				
Mean	1.23	1.12	1.44	4.88
Std Dev.	7.68	2.51	5.24	58.22
Fruits				
Mean	1.82	10.89	3.93	3.64
Std Dev.	3.27	44.96	11.60	17.23
Spices				
Mean	0.73	2.52	1.07	1.83
Std Dev.	0.77	4.21	1.62	5.35
Cash crops				
Mean	5.14	3.01	0.18	6.01
Std Dev.	55.76	28.19	1.46	80.47

Source: Own computation based on RCC Survey 2023

Below, we present a graph to demonstrate whether the net crop production value distribution function across each of the selected intensification practices does not have the same distribution function (Figure 3.3). The farm income from crop production is defined as the gross value of all annual crops grown on the farm minus input costs. This measure is used instead of crop yield to address the challenges of aggregating multiple cropping and cost differences across practices. Although a more rigorous multivariate analysis is warranted, a non-parametric crop net income distribution analysis indicates that all the sustainable practices considered in this analysis influence the net value of crop production. The cumulative distribution of the net value of crop production with inorganic fertilizer, improved seeds, agro-chemicals, and irrigation surpasses the farm income cumulative distribution on farms without these sustainable

agricultural practices. This observation is supported by the graphs (Figure 3.3a - d) of the cumulative density function (CDF) of crop net income with intensification practices consistently below or equal to that of farms without these practices. This offers a compelling economic incentive for farmers to adopt each of these adaptation practices. On the other hand, this would also suggest that modern technologies should be adopted more extensively, a reason for why it is not could be the fact that traditional varieties are associated with lower risks.

Figure 3.3. Cumulative distribution for the impact of modern technologies on farm income

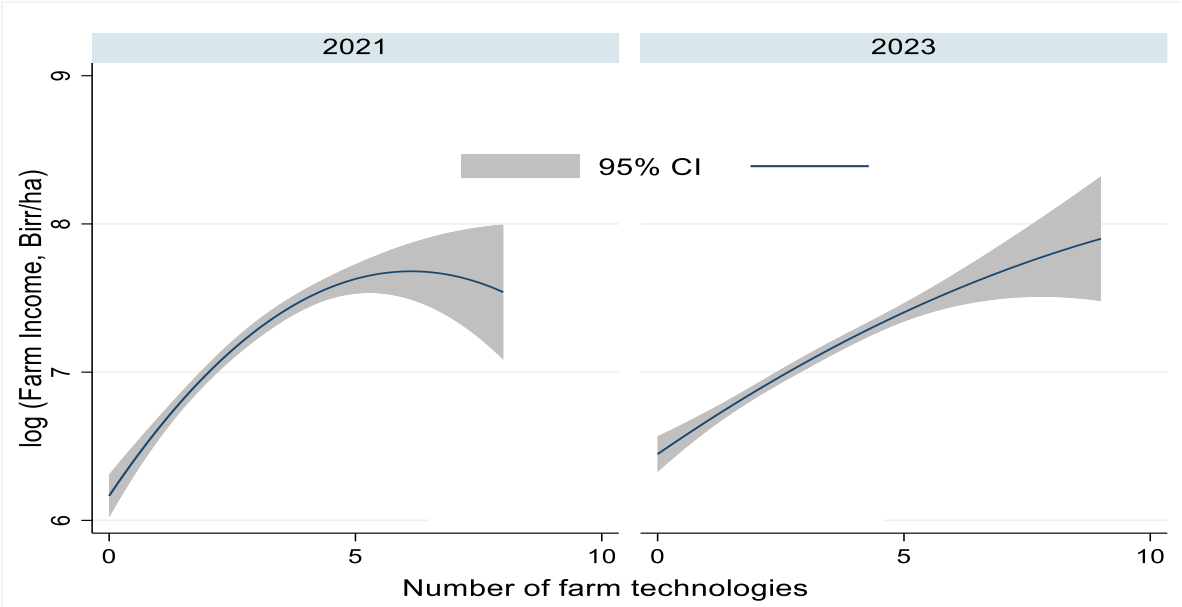


Source: Own Computation based on RCC Survey 2023

In addition to the aforementioned positive impact of each farming technology on net farm income, the survey results also underscore a positive correlation between average farm net income and the number of sustainable practices employed (Figure 3.4). This suggests a complementary relationship, hinting at possible synergies among the practices that could yield co-benefits. This trend is especially evident in 2023. Though a more thorough multivariate

analysis is essential, this finding can serve as a compelling incentive for farmers to integrate multiple technologies. Our methodology augments the current literature by accommodating the crucial effect of interrelationships among the practices. We not only examine the determinants of the likelihood of adopting a single practice but also delve into the extent of utilization of various adaptation practices at the farm level.

Figure 3.4. Average farm income (Birr/ha) and number of agricultural technologies adopted



Source: Own Computation based on RCC Survey 2021 and 2023

3.4 Trees and permanent crops

We observed that farm households in the study areas produced and benefited from trees and permanent crops. Table 3.11 indicated that overall, the percentage of tree grower households, number of trees grown, and revenue generated from trees in 2023 are statistically significantly higher compared with the year 2021. About 64 percent of the households in 2021 and 73 percent of households in 2023 grew trees and permanent crops on at least one of their parcels. Among tree-growers, the average number of trees grown was about 731 in 2021 and 1,094 in 2023,

which of course hides a large variance. The results may indicate the important role of integrating trees and permanent crops with annual crop production by farmers to provide shade, a steady supply of food and/or income throughout the year, arrest degradation, maintain soil fertility, diversify income sources, enhance the efficient use of soil nutrients, water, and radiation, and provide regular employment. While fitting directly into the system of crop-livestock farming to provide both animal feed and green manure to the cropland, growing trees and permanent crops could also be a strategy to compensate for income loss in seasons of crop failures. However, an average household generated about 8 to 9 thousand Birr from trees and permanent crops during the study period. Compared with 2021, the inflation-adjusted revenue generated from trees and permanent crops in 2023 did not show a statistically significant difference.

Table 3.11. Trees/permanent crops - number of growers, number of trees and income

Description	Year		Difference
	2021	2023	
Tree grower (percentage of households)	63.63 (0.481)	72.89 (0.445)	9.26***
Tree grown (Number of trees)	731.7233 (4575.73)	1094.004 (7035.72)	362.28**
Revenue from tree (Birr)	5154.171 (24993.57)	7991.382 (49850.68)	-922.71

Source: Own Computation based on RCC Survey 2023

Note: Numbers in parenthesis are standard deviations; Tree revenue is deflated with real terms.

3.5 Extension service

The agricultural extension service plays a central role in the process of agricultural transformation, technology adoption, and commercialization in Ethiopia (Girma & Kuma, 2022; Albore, 2018). These services are a vital source of information on agronomic practices

as well as climate issues. The availability of improved climatic and agricultural information enables farmers to make comparatively viable decisions about alternative adaptations, allowing them to cope better with climate changes. In the survey areas, the most widely accessed extension services in the two waves of RCC surveys are fertilizer application, modern seed variety, and pest and disease control.

Table 3.12. Extension service provision

	2021				2023			
	Number of obs.		% of application		Number of obs.		% of application	
Extension service types	Yes	No	Yes	No	Yes	No	Yes	No
Modern crop variety	782	403	66.0	34.0	689	455	60.2	39.8
Fertilizer use	1,015	170	85.7	14.4	984	160	86.0	14.0
Climate change adaptation	92	1,093	7.8	92.2	215	929	18.8	81.2
Pest/disease control	339	846	28.6	71.4	414	730	36.2	63.8
Livestock production	164	1,021	13.8	86.2	220	924	19.2	79.8
Tree planting	820	365	69.2	30.8	230	914	20.1	79.9

Source: Own computation based on RCC Survey 2021 and 2023

In the 2023 RCC survey, of the households who reported using extension services, 86 percent, 60.2 percent, and 36.2 percent utilized the services for fertilizer application, modern seed variety, and pest and disease control, respectively. The proportion of households using pest and disease control increased relative to the 2021 RCC survey result (from 29 to 36.2 percent), whereas that of modern seed variety decreased from 66 percent to 60.1 percent. However, the proportion of households using fertilizer application remains high and does not show significant change between the two surveys (See Table 3.12). Table 3.12 indicates that the proportion of households seeking extension service for climate change-related information rose from 7.8 percent in 2021 to 18.8 percent in 2023, highlighting the growing and encouraging role of extension services in climate change adaptation.

In relative terms, the proportion of households that use extension services for sustainable agricultural practices and agricultural water-management practices on their farms rose from 21.9 and 28.6 percent in 2021 to 25.9 and 32.7 percent respectively over the period (Table 3.13). It is believed that extension contacts had a positive effect, as farmers who had contact with extension agents were more likely to adopt adaptation measures in response to the changing climate. Table 3.12 also indicates that a larger proportion of households use extension services for advice related to input market prices, and this increased over the survey period. In contrast, the proportion seeking advice on output market prices declined over the survey period.

Table 3.13. Sustainable agricultural practices, water management, and market prices

	2021				2023			
	# of obs.		% of application		# of obs.		% of application	
Extension service types	Yes	No	Yes	No	Yes	No	Yes	No
Agricultural water management	260	925	21.9	78.1	297	847	25.9	74.1
Sustainable agricultural practices	339	846	28.6	71.4	374	770	32.7	67.3
Output market prices	42	1144	3.5	96.5	91	1053	8.0	92.0
Input market prices	81	1105	7.7	92.3	163	981	14.2	84.8

Source: Own computation based on RCC Survey 2021 and 2023

Over the survey period, of the sample households that had received extension services, the proportion of those who received it every week and two weeks decreased and that of every month, two months, and three months increased whereas those who took every four months and beyond slightly decreased (Table 3.14).

Table 3.14. Frequency of extension services

Frequency of meeting extension agent	2021		2023	
	Freq.	%	Freq.	%
Every week	79	6.7	59	5.2
Every 2 weeks	116	9.8	81	7.1
Every month	149	12.6	175	15.3
Every 2 months	109	9.2	118	10.3
Every 3 months	128	10.8	166	14.5
Every 4 months	157	13.3	132	11.5
Every 5 months	91	7.7	51	4.5
Every 6 months	259	21.9	219	19.1
Every year	97	8.2	143	12.5

Source: Own computation based on RCC Survey 2021 and 2023

Mobile phone-based extension services and IVR (Interactive Voice Response) based extension services offer alternative methods for households to access extension advice compared to physical visits. The number of households that accessed extension services via mobile phone decreased in 2023 compared to 2021, dropping from 66 percent to 63.7 percent. However, the proportion of those who accessed extension services through IVR saw an increase (as indicated in Table 3.15), which is a positive development.

Table 3.15. Mobile phone ownership and advice through IVR

Item and service	Response	2021		2023	
		Freq.	%	Freq.	%
Got advice through mobile phone (ownership)	Yes	1315	66.1	1,267	63.7
	No	674	33.9	723	36.3
Got advice through (IVR Interactive Voice)	Yes	17	1.3	29	2.3
	No	1298	98.7	1,239	97.7

Source: Own computation based on RCC Survey 2021 and 2023

3.6 Fertilizer and improved seed use

In developing countries like Ethiopia, several interacting poverty and productivity traps hinder the widespread use of agricultural inputs (Abebe & Debebe, 2019). Among the constraints are limited availability and high cost of inputs, a lack of varieties tailored to farmers' needs, erratic and insufficient rainfall, and restricted access to financial services, such as credit, savings, and insurance (Bekele et al., 2020). During the RCC period, there was an increase in the average quantity of fertilizer and agrochemicals utilized by the sample households, while the average quantities of modern and traditional seeds decreased (as illustrated in Table 3.16). Specifically, the average quantities of fertilizer and agrochemicals rose from approximately 226 kg and 9 litres to 245.4 kg and 18.5 litres, respectively. In contrast, the average quantities of modern and traditional seeds decreased considerably from 138.4kg and 110.3kg to 78.5kg and 71.6 kg, respectively (as shown in Table 3.16). This decline in the average quantity of improved seeds amid a changing climate could be worrisome and might necessitate interventions, but on the other hand, the reason for this decline could be caution by the farmers under uncertain climate conditions.

Table 3.16. Average quantity of inputs for 2020/21 and 2022/23 cropping seasons

	2021			2023		
Input type	Obs.	Mean	SD	Obs.	Mean	SD
Fertilizer (Kg)	1379	225.8	416.7	1348	245.4	708.7
Modern seeds (Kg)	739	138.4	1311.1	692	78.5	287.0
Traditional seeds (Kg)	818	110.3	542.5	668	71.6	179.5
Agrochemicals (Lit)	830	9.0	115.4	822	18.5	257.5

Source: Own computation based on RCC Survey 2023 and 2021

The prices of these modern agricultural inputs have risen over the survey period (as shown in Table 3.17), with increases ranging from 104.7 percent for fertilizer to 30 percent for traditional seeds, resulting in an overall average price hike of 67.2 percent. Notably, despite the significant price hikes for both fertilizer and agrochemicals, there was an uptick in the average quantities used (as evidenced in Table 3.16) during the survey period.

Table 3.17. Average cost of inputs in ETB for the 2020/21 and 2022/23 cropping seasons

	2021			2023*			Average price change
Input type	Obs.	Mean	SD	Obs.	Mean	SD	%
Fertilizer	1365	3237.2	3867.1	1342	6625.0	7283.9	104.7
Modern seeds	703	1473.1	4304.7	670	2470.7	1782.9	76.5
Traditional seed	693	1301.2	2561.5	589	1690.7	3315.8	29.9
Agrochemicals	822	943.5	1829.2	799	1572.6	4100.6	66.7

Source: Own computation based on RCC Survey 2023 and 2021

Note: Mean is adjusted for extreme values in case of fertilizer and improved seeds.

3.7 Irrigation

Soil and water conservation and the adoption of irrigated agriculture are climate-smart agricultural practices, and they represent long-term investments for transformative adaptations (Zanotti et al., 2020). For the Ethiopian government, irrigation stands as a cornerstone of economic development, as outlined in its 10-year Development Plan (PDC, 2021).

In the survey, the sample households were asked if they currently use irrigation. The data reveals that the number of households employing irrigation dropped from 295 in 2021 to 258 in 2023, marking a decline of approximately 12.5 percent. This decrease might be attributed to the lack of adoption of micro and small irrigation practices (Wakeyo & Gardebroek, 2015) and the stagnation of communal irrigation schemes due to a lack of maintenance, a trend widely observed in Ethiopia (Berhe et al., 2022; Wakeyo & Ejeta, 2022). Interruptions in key projects like the AGP, which extensively supports irrigation, might also play a role. The data shows that the decline in the number of households utilizing irrigation over the survey period is primarily noted in the Amhara and Oromia regions, with respective drops from 158 to 147 and 78 to 55 households. The data also indicates a decline in the number of current irrigation users in AGP Woredas (from 139 to 121), SLMP Woredas (from 76 to 59), and non-program Woredas (from

24 to 17). However, in the PSNP Woredas, the number of households currently using irrigation rose from 56 to 61.

The use of irrigation by plot number declined even more substantially compared to the decline in the number of irrigation-user households. When asked whether the plot is currently irrigated in the current season, only 381 plots (4.7 percent) were reported to be irrigated, whereas in 2021, about 706 plots (9 percent) were irrigated. The decline by plot is higher in Oromia (from 300 to 78) and Amhara (from 272 to 203 plots) regions.

The proportion of irrigated plots by program Woredas is also worth analysing. As expected, the proportion of households that used irrigation was highest in AGP Woredas (14.9 percent of the total number of plots), followed by non-program Woredas (8.9 percent), PSNP Woredas (6.4 percent), and SLMP Woredas (5.9 percent). The data indicates that by program Woredas, the highest decline in the number of irrigated plots over the survey period is observed in non-program Woredas (by 44 plots), followed by AGP Woredas (36 plots), and least in PSNP Woredas, consistent with other analyses by the number of households who currently use irrigation.

The sample households employ various types of irrigation practices and technologies (Table 3.18). Out of the 258 households that utilized irrigation in 2023, nearly 36.1 percent use dam/ weir irrigation, 24.8 percent employ furrow-based irrigation, 14.7 percent use a combination of multiple irrigation technologies, and 10.1 percent use pump irrigation. As the table illustrates, the number of users of dam/weir communal irrigation has risen, but the number of pump irrigation and on-farm water management users has decreased. Meanwhile, the count of furrow-based irrigation users has not shown significant change.

Table 3.18. Types of irrigation technology

Type of irrigation technology	2021		2023	
	No. of users	% of total	No. of users	% of total
Dam/weir communal irrigation	79	26.8	93	36.1
Drip irrigation	6	2.0	2	0.8
Pump irrigation	42	14.2	26	10.1
Hand-dug well	11	3.7	6	2.3
Individual W. harvesting	3	1.0	7	2.7
Community ponds	8	2.7	6	2.3
Low-cost drilling technologies	7	2.4	1	0.4
Deep well	-	-	2	0.8
Hi pump irrigation	-	-	1	0.4
On-farm water management	54	18.3	11	4.3
Furrow based	63	21.4	64	24.8
Multiple/combination of technologies	-	-	38	14.7
Others	4	1.4	1	0.4
Total	280	94.9	258	100.1

Source: Own computation based on RCC Survey 2021 and 2023

The sample households were asked if they had received training in irrigation use. In 2021, only 273 out of the 1,990 households, or 13.7 percent, had undergone irrigation training. However, by 2023, this number increased to 345 households, representing 17.4 percent, marking an improvement. Similar to the results from 2021, households in AGP Woredas had the highest rate of training participation at 27.3 percent, while those in PSNP Woredas had the lowest, consistent with findings from the 2021 survey.

Another inquiry in this section pertained to the challenges faced by those who employ irrigation. Approximately 79.8 percent of irrigators identified the scarcity of irrigation water sources as the primary challenge. This was followed by conflicts over water use, highlighted by 31 percent of respondents, and a lack of motor pumps, as indicated by 21 percent of the

irrigators. These constraints consistently emerged as the most frequently cited challenges. A comparative analysis across the survey periods reveals a significant rise in irrigation water shortages and conflicts over water usage, potentially due to the effects of climate change on water availability and its applications.

The households in the sample were asked if they employed rainwater harvesting/irrigation as a long-term resilience strategy to mitigate climatic shocks. About 88 households (only 4.4 percent) responded affirmatively to using water harvesting in the 2023 survey. This figure represents a substantial decline compared to the number reported in 2021, which was 306 households (about 15.3 percent), possibly due to discontinuation of those irrigation practices.

Finally, given that the government is actively promoting irrigated wheat production for self-sufficiency, the sample households were asked if they had produced irrigated wheat in the previous season and whether they were interested in doing so in the future. The data indicates that 89 out of 258 irrigators (34.5 percent) produced irrigated wheat, but a larger portion of the sample households (63.6 percent of the irrigators) intend to produce wheat in the future.

3.8 Livestock

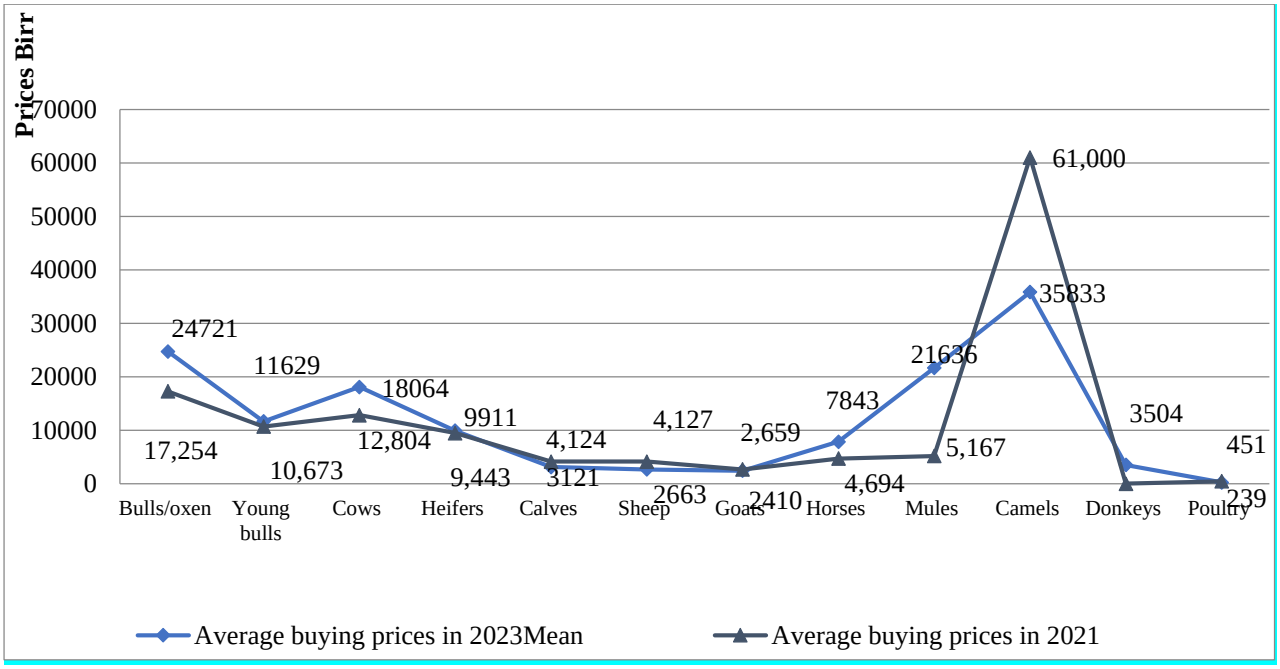
Livestock rearing assists in mitigating the production and price risks faced by smallholder households, offering opportunities for supplemental income (Wodajo et al. 2020; Mekuria and Mekonnen, 2018). The mixed mode of production is predominant in the highlands and non-pastoral regions of the country. For example, in the 2023 survey of the 1995 sample households, 1,729 or 86.7 percent practiced a mixed farming system, a slight decrease from 89 percent in 2021. Mixed farming enables farmers to counter various risks, such as those related to weather, disease, and price fluctuations.

The survey data reveals that between the two survey periods, there was an increase in the aggregate average ownership of oxen/bull, goat, and mules. However, a decrease was observed for other livestock types, although this varied by region. A combination of declining feed availability, grazing shortages, and the prevalence of disease has prompted farmers in pastoral regions to shift towards rearing smaller ruminants instead of cattle (Bekele et al. 2020). This adaptation may serve as a coping strategy for households, bolstering resilience to climate change impacts.

In terms of income, the aggregate average nominal annual earnings from each type of livestock experienced an increase in 2023 compared to 2021, averaging a 3.6-fold increase, a change attributed to rising inflation. In 2023, the highest average aggregate nominal income came from the sale of oxen, bringing in 47.6 thousand ETB, while the lowest was from the sale of poultry at 3 thousand ETB. This income source remained consistent throughout both survey periods. However, while prices have generally increased between 2021 and 2023, we should keep in mind the overall consumer price index increase of 72.9 percent over the same period.

Figures 3.5 and 3.6 provide a visual representation of the average buying and selling prices for each livestock type for the years 2023 and 2021. From these figures, it's discernible that in 2023, the average buying prices for bulls/oxen, young bulls, cows, horses, donkeys, and poultry witnessed an upswing compared to 2021. On the other hand, the average buying prices for heifers, calves, sheep, and goats experienced a modest increase, less than 5 percent. Interestingly, camels' average buying price appeared to decrease. However, caution is advised when drawing comparisons between 2023 and 2021 for camels, as the 2021 data is based on a solitary observation, rendering it an unreliable point of comparison.

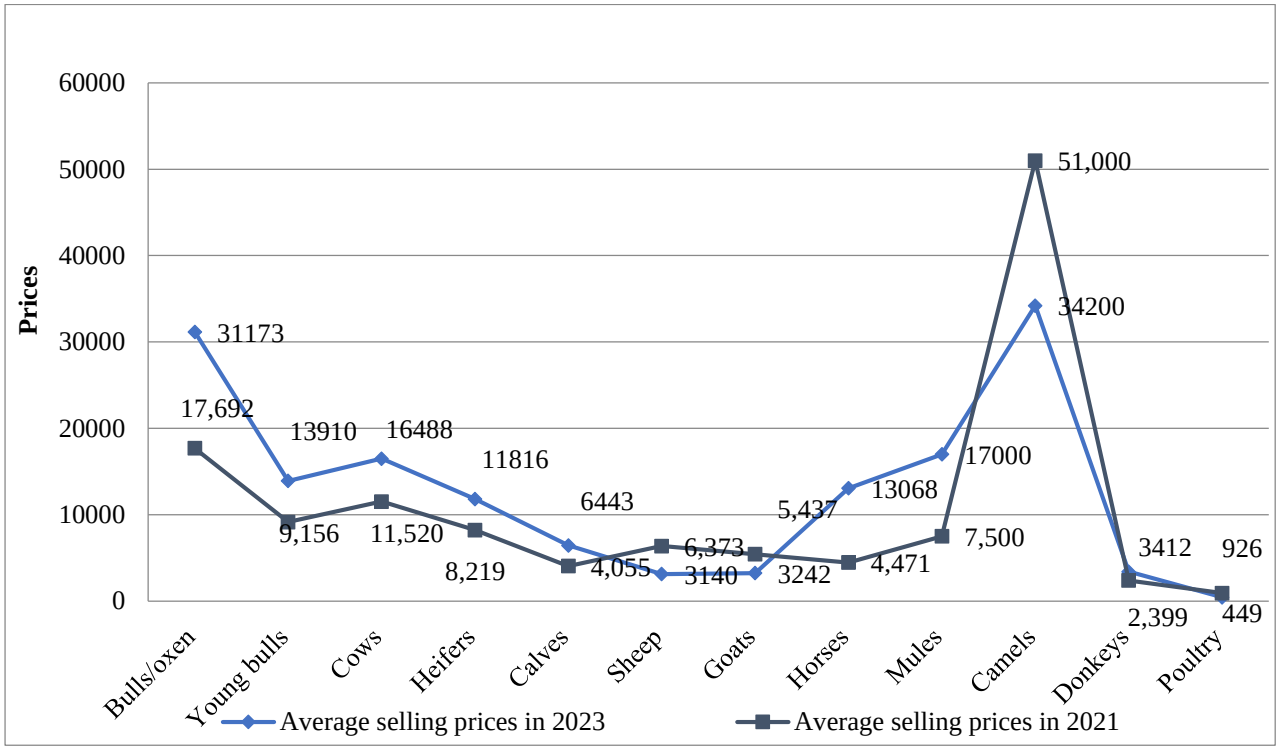
Figure 3.5. Average nominal buying prices of livestock in 2021 and 2023



Source: Own computation based on RCC Survey 2021 and 2023

In terms of average selling prices across the survey duration, Figure 3.5 reveals that with the exception of sheep, goat, and camel, there was an increase in the selling prices for all other livestock types between the two survey years. Notably, the most substantial price hikes were observed in mules and camels, followed closely by oxen/bull, as illustrated in Figure 3.6.

Figure 3.6. Average Selling prices of livestock in 2023 and 2021 (ETB/Head)



Source: Own computation based on RCC Survey 2021 and 2023

Households were inquired if they had sold livestock as a countermeasure against drought. In the 2023 survey, out of the 546 households that responded, 326 (or 57.8 percent) indicated they sold livestock to mitigate risks. This figure is marginally higher than the 55 percent of households in 2021 who reported doing the same.

Another aspect addressed was the current state of grazing land availability in comparison to the past. The 2023 data reveals that out of 1,995 households, around 1,138 (or 57 percent) believe that the availability of grazing land is either poor or very poor. In contrast, a mere 402 households (20.7 percent) described it as good or very good, highlighting the significant concerns related to grazing land. Additionally, when asked about the use of modern feeds, only 132 households (6.6 percent) affirmed using them. This is a decrease from the 12.3 percent

who reported the same in 2021. The reduction underscores the idea that achieving livestock adaptation amidst climate change necessitates greater dedication and targeted strategies.

Households were also asked whether they have improved water sources for their livestock. In the 2023 survey data, only 236 households (11.6 percent) reported positively. The proportion is lower than the proportion of households in 2021 (25.4 percent). By region, those households in Oromia and SNNPR had greater access to improved water than those in other regions. Finally, the households were asked whether they had livestock insurance for drought. Interestingly, only 4 of the 1995 households reported in the 2023 survey that they owned livestock insurance. This figure is less than the figure reported in 2021 which was 19 out of the 1,974 households.

Beehives

Beehives are sources of additional income for rural households, especially for the landless. The 2023 survey data indicates that the number of sample households owning any kind of beehive declined from 223 in 2021 to 206 in 2023 (a decline of 7.6 percent). In both survey years, the majority of households owned traditional beehives, accounting for about 78.4 percent, and this proportion remained stable over the survey period. Of the households who owned beehives in 2023 and 2021, 27 and 44 sample households respectively owned two or three types of beehives. Those households owning traditional beehives had between one and 100 in 2023 and between one and 200 in 2021. Conversely, those owning transitional and modern beehives had between one and 12 and one and 30 beehives in 2023, and between one and nine and one and 10 beehives in 2021, respectively. By region, the number of households owning beehives decreased in all regions over the survey period—by 3 percent in Amhara, 10 percent in Oromia, 8 percent in SNNPR, and one percent in Gambela, but it increased only in Dire Dawa. The decline in most of the regions could be attributed to environmental or climate challenges, or the decreasing role of flagship projects like AGP.

Lastly, the nominal average income from beehives for the sample households by region over the survey period is summarized in Table 3.19. This table reveals that the average income from beehive ownership increased in Amhara and Gambela by 55 percent and 8 percent, respectively. However, it decreased in Oromia and SNNP by 18 percent and 4 percent, respectively. When

regional income from honey sales is adjusted using the average Consumer Price Index (CPI), the deflated average income dropped from 4315 in 2021 to 2,787 in February 2023, as depicted in Table 3.19.

Table 3.19. Average nominal and deflated income from honey sold (in ETB), by region during 2021 and 2023

Region	Average income from Beehives 2021		Average income from Beehive 2023		
	Mean (nominal)	SD	Mean(nominal)	SD	Mean (real)
Amhara	5,129	858	7952	19258	4,599
Oromia	5,569	825	4562	8142	2,639
Somali	1,200	800			
SNNPR	1,755	392	1691	3306	978
Gambela	4,699	955	5062	6870	2,928
Dire Dawa			4000	6928	2,313
Total	4,315	417	4819	12010	2,787

Source: Own Computation based on RCC Survey 2021 and 2023

Note: Real: deflated against 2021 value by 72.9 percent (source: CPI).

CHAPTER 4: ENGAGEMENT IN NON-FARM ACTIVITIES/ ENTERPRISES

4.1 Household participation in off farm activities

Employment opportunities outside agriculture remain limited in the study areas, a trend observed in many parts of the country. Of the total sample households covered in the survey (i.e., 1,995), 581, or close to 30 percent, participate in off-farm activities, highlighting a low engagement in rural enterprises. However, there is a slight improvement in off-farm activities compared to the first survey conducted in 2021, where only 499 households, representing 25 percent of the sample, were involved in such enterprises. The level of diversification remains low in the second round; only 63 households, or about 10.8 percent of those engaged in off-farm activities (or about 3 percent of the total sample), are involved in more than one off-farm activity. The vast majority of households focus on just one type of off-farm enterprise (see Table 4.1). This is likely due to a lack of available choices and weak institutional support promoting engagement in off-farm activities.

Table 4.1. Number of households engaged in off-farm enterprises

Level of off farm participation	2021			2023		
	Freq.	Percent	Cum.	Freq.	Percent	Cum.
No Engagement	1501	75.05	75.05	1414	70.88	70.88
Engagement in one	443	22.15	97.20	518	25.96	96.84
Engagement in two	54	2.70	99.90	61	3.06	99.90
Engagement in three	2	0.10	100.00	2	0.10	100.00
Total	2000	100.00		1995	100.00	

Source: Own Computation based on RCC Survey 2021 and 2023

4.2 Income from off-farm activities

Among the selected off-farm enterprises, selling processed food items such as tella, areke, enjera, kollo, fish, etc., was the leading enterprise with a relatively large number of households participating during the first survey. While this business remained dominant in the second round survey, there was a decline in participation: 173 sampled households, down from 201 during the first survey.

The number of households engaged in street and market sales declined from 114 to 104 during the second survey period, and the number of households owning shops also decreased from 64 to 54. Conversely, the number of households providing transport services saw a significant increase, jumping from 19 to 57. This trend suggests that providing transport services using motorcycles and Bajaj has become a more lucrative business in rural Ethiopia.

Although there was a decline in the number of households engaged in certain enterprises during the second survey period, it is noteworthy that many households ventured into new business activities, such as selling crops and pursuing small trading ventures (as shown in Table 4.2).

Table 4.2. Number of households engaged in each off-farm activity

	2021				2023			
	Number of households		Income generated		Number of households		Income generated	
Off farm enterprises	Freq.	Percent	Mean	SD	Freq.	Percent	Mean	SD
Household owned shop	64	11.49	16,877	26,050	54	8.36	31,695	56,604
Barber	5	0.90	8,040	7,886	6	0.93	16,733	10,749
Transport service	19	3.41	30,891	28,770	57	8.82	25,756	25,476
Selling processed food	201	36.09	10,888	14,192	173	26.78	13,784	14,186
Selling anything on street/ market	114	20.47	11,114	13,063	104	16.10	15,871	13,267
Other	154	27.65	19,289	38,968	88	13.62	33,248	159,241
Selling crop	.	.	.	.	98	15.17	22,732	39,266
Trading business	.	.	.	.	66	10.22	16,173	13,918
Total	557	100.00	14,602	25,549	646	100.00	20,954	64,244

Source: Own computation based on RCC Survey 2021 and 2023

4.3 Number of months in operation

The number of off-farm enterprises operating for only one month increased from 1.4 percent of the total during the first survey to 2.6 percent in the second survey. Conversely, enterprises operating for four months declined from 8.8 percent to 6.7 percent. Though the percentage remained constant, enterprises operating for half a year rose from 67 to 80. Additionally, businesses that operate year-round increased in number from 270 to 303; however, their proportion in the total sample showed a decline (see Table 4.3). Overall, households that operate for more than 6 months (i.e., 7 to 12 months) increased from 335 to 396, representing a growth of 17 percent in the second survey.

Table 4.3. Number of months in operation

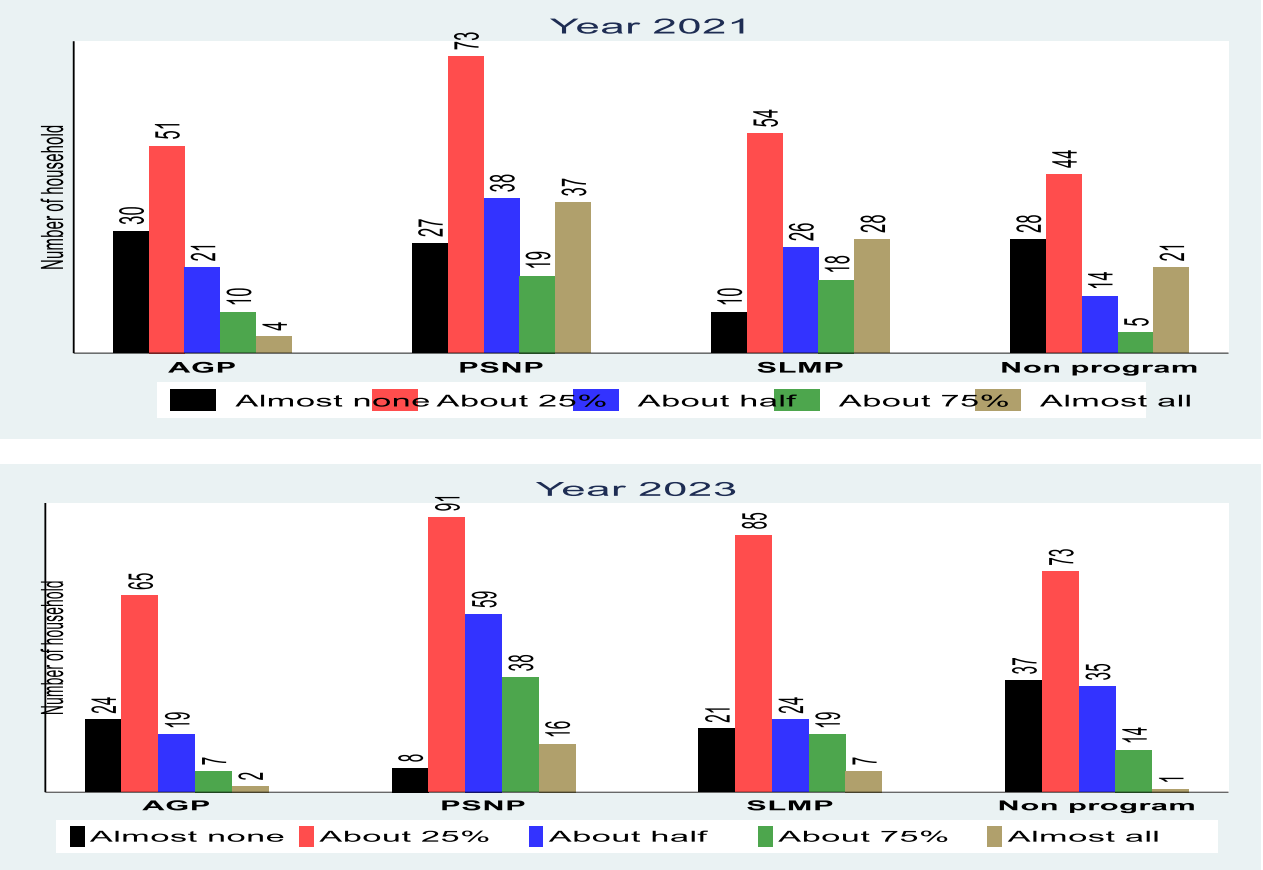
Months in operation	2021			2023		
	Freq.	Percent	Cum.	Freq.	Percent	Cum.
1	**8**	**1.44**	**1.44**	**17**	**2.63**	**2.63**
2	23	4.13	5.57	17	2.63	5.26
3	35	6.28	11.85	58	8.98	14.24
4	**49**	**8.80**	**20.65**	**43**	**6.66**	**20.90**
5	40	7.18	27.83	38	5.88	26.78
6	**67**	**12.03**	**39.86**	**80**	**12.38**	39.16
7	11	1.97	41.83	18	2.79	41.95
8	35	6.28	48.11	41	6.35	48.30
9	3	0.54	**48.65**	12	1.86	50.15
10	15	2.69	51.35	14	2.17	52.32
11	1	0.18	51.53	5	0.77	53.10
12	270	**48.47**	100.0	303	**46.90**	100.00
Total	557	100.00		646	100.00	

Source: Own computation based on RCC Survey 2021 and 2023

4.4 Share of income from off-farm activities by program

While the number of respondents differed for each program, nearly all participants in both surveys stated that earnings from off-farm enterprises made up about 25 percent of their total earnings. Figure 4.1 shows the share of total income generated from off-farm activities by program and year. Notably, respondents from PSNP Woredas constituted the majority in both the first and second round surveys.

Figure 4.1. Share of total income generated from off-farm activities, by program and year



Source: Own Computation based on RCC Survey 2023

4.5 Benefits of being engaged in off farm activities

Regarding the contribution of off-farm enterprises to household livelihood, approximately 78.9 percent of respondents in the first survey and 75.7 percent in the second believed that participation in such enterprises would make a substantial contribution to their family's well-being. Over the two survey periods, there was a significant shift in households' perceptions about the benefits of engaging in off-farm enterprises, with an 8.5 percent increase in the second period's respondents believing in its high contribution.

Table 4.4. Benefit of being engaged if off-farm activities

Benefit from being engaged	2021		2023	
	Freq.	Percent	Freq.	Percent
Substantially high	179	20.46	186	18.81
High	511	58.40	563	56.93
Neutral	94	10.74	100	10.11
Low	89	10.17	133	13.45
Very low	2	0.23	7	0.71
Total	875	100.00	989	100.00

Source: Own computation based on RCC Survey 2021 and 2023

4.6 Other income sources

The primary alternative income source for households in the study area remains wage/salary, which saw an increase from 276 to 349 households during the second survey. Remittance serves as the second most significant source of additional income, rising from 223 to 312 households in the second period. Land rental also saw an increase, going from 124 to 140 households. The most significant average annual income is generated from shops, followed by wages and salaries, and then cart rental.

Table 4.5. Number of households with other income sources

Other income sources	2021		2023	
	Freq.	Percent	Freq.	Percent
Remittances	223	30.18	312	36.19
Wages/salaries	276	37.35	349	40.49
Pension	11	1.49	9	1.04
Shop etc	72	9.74	34	3.94
Land rental	124	16.78	140	16.24
Cart rental	33	4.47	18	2.09
Total	739	100.00	862	100.00

Source: Own computation based on RCC Survey 2021 and 2023

As shown in Table 4.5, both the average and median real income from other sources were higher in the first survey period (2021) compared to the second survey period (2023). This discrepancy could be attributed to the historically high inflation rate the country is experiencing. In the second period, for those households that reported, income from shops was the highest, followed by wage/salary and then cart rental.

The average income from other sources, as illustrated in Figure 4.2 below, has grown for all programs and non-program Woredas in the second survey period. AGP Woredas recorded the most significant change between the two survey periods.

Figure 4.2. Average income from other income sources, by program

Source: Own Computation based on RCC Survey 2023

CHAPTER 5: CONSUMPTION

5.1 Consumption-food aggregates

This sub-section provides a descriptive analysis of the dietary diversity and dietary intake patterns of the sampled households, relying on food consumption data from 2021 and 2023. Drawing from the literature and the data on hand, our metrics for dietary diversity include the household dietary diversity score (HDDS) and the percentage of households consuming at least one item from a specific food group[2] (Kennedy et al. 2013, Labadarios et al. 2011, Rue 2003, Sibhatu et al. 2022). The HDDS counts the variety of food groups from which a household has consumed at least one item. These indicators of dietary diversity operate on the premise that as more food groups become part of a household's diet, the likelihood of meeting essential nutrient requirements increases (Labadarios et al. 2011).

In terms of gauging dietary intake, we account for calorie and protein consumption using a food consumption table curated for Ethiopia (EHNRI 2000). For all cases, dietary intake metrics are presented per adult equivalent daily, with units being kilocalories (kcal) for calories, and grams (gms) for protein.

Both the 2021 and 2023 surveys gathered food consumption data over the week preceding each respective survey. In every case, we present both median and mean values to understand potential variations due to outliers. We also substituted the largest 1 percent of values with the 99th percentile. This section also incorporates standard deviations and results of tests

[2] FDRE (2022) identifies six food groups for Ethiopia: Cereals and tubers (cereals, grains, white roots and tubers); legumes; nuts and oilseeds; animal source foods (milk and dairy foods, meat, fish, eggs), fruits and vegetables, and oil and fat. We follow this, except that we also consider international guidelines and separated some of the food groups listed above. In particular, we include tubers and stem as separate groups from cereals; and milk, dairy and egg as separate from meat and fish. We also include beverages and stimulants as an additional food group making the total number of groups nine instead of the six listed above. We also use the terms ‘pulses’ instead of ‘legumes’, and ‘oilseeds’ instead of ‘nuts and oilseeds’.

examining the statistical significance of mean differences between the survey years of 2021 and 2023.

Table 5.1 presents the dietary diversity of sample households for 2021 and 2023, measured by HDDS and the percentage of households that consumed at least one item from each food group. The table considers the following nine food groups: cereals, pulses, oilseeds, fruits and vegetables, tubers and stems, meat and fish, beverages and stimulants, dairy and eggs, and oil and fat.

The mean HDDS was higher in 2023 at 5.52 compared to 5.42 in 2021, and this difference is statistically significant. The median for both years was consistently at 5.0. This indicates that, from the eight food groups, an average household consumed at least one food item from around five groups. Following the framework set by Kennedy et al. (2013), this average HDDS can be defined as medium dietary diversity.

Looking at individual food groups, there was an increase in the percentage of households consuming at least one item from the 'pulses' group, growing from 72 percent in 2021 to 79 percent in 2023. Similarly, consumption from the 'meat and fish' group also saw an increase, rising from 17 percent in 2021 to 23 percent in 2023, and both these changes are statistically significant.

Conversely, there was a decline in consumption for the 'oilseeds' and 'tubers and stem' categories. The percentage of households consuming oilseeds decreased from 10 percent to 6 percent, and for tubers and stem, it dropped from 29 percent to 26 percent. Both these declines are statistically significant.

For the other food groups, the changes in consumption percentages between the two years, 2021 and 2023, were not statistically significant. In terms of the highest consumption, 'cereals' stood out with a complete 100 percent of the sample households. The lowest was the 'oilseeds' group, at 10 percent in 2021 and 6 percent in 2023, followed closely by the 'meat and fish' group, which was at 17 percent in 2021 and 23 percent in 2023.

Thus, even though there's a general uptake in the average number of food groups from which households consumed at least one food item, there is a notable rise in the percentage of

households consuming at least one food item from the 'pulses' and 'meat and fish' categories. Conversely, there is a decline in consumption within the 'oilseeds' and 'tubers and stem' categories.

Table 5.1. Dietary diversity by survey year

	2021			2023			
	Median (1)	Mean (2)	Std Dev(3)	Median (4)	Mean (5)	Std Dev(6)	Diff. (5-2)
HDDS	5.0	5.42	1.07	5.0	5.52	1.08	0.09***
Cereals (%)	1.0	1.00	0.00	1.0	1.00	0.03	0.00
Pulses (%)	1.0	0.72	0.45	1.0	0.79	0.41	0.06***
Oilseeds (%)	0.0	0.10	0.29	0.0	0.06	0.24	-0.03***
Fruits and vegetables (%)	1.0	0.98	0.13	1.0	0.99	0.12	0.00
Tubers and stem (%)	0.0	0.29	0.45	0.0	0.26	0.44	-0.03**
Meat and fish (%)	0.0	0.17	0.38	0.0	0.23	0.42	0.06***
Beverages and stimulants (%)	1.0	0.94	0.24	1.0	0.95	0.22	0.01
Dairy and egg (%)	0.0	0.35	0.48	0.0	0.36	0.48	0.02
Oil and fat (%)	1.0	0.88	0.33	1.0	0.88	0.33	0.00
No. of obs.		2000			1995		

Source: Own computation based on RCC Survey 2021 and 2023

Note: For food groups the figures represent percent of the sample that consumes at least one food item from the group.

Table 5.2 presents the dietary intake per adult equivalent per day, comparing data from 2021 and 2023 for calories and protein. The data reveals a statistically significant decline in the average calorie intake, dropping from 2055 kcal in 2021 to 1943 kcal in 2023. However, the mean protein intake remained stable without any significant change between the two survey years.

Table 5.2. Dietary intake per adult equivalent per day by survey year

	2021			2023			
	Median (1)	Mean (2)	Std Dev (3)	Median (4)	Mean (5)	Std Dev (6)	Diff. (5-2)
Calorie (kcal)	1745.8	2055.4	1426.9	1638.5	1942.9	1298.5	-112.5***
Protein (gms)	66.1	78.1	59.6	61.6	77.6	61.0	-0.5
No. of obs.		2000			1995		

Source: Own computation based on RCC Survey 2021 and 2023

Table 5.3 presents the dietary intake per adult equivalent per day, differentiated by program and non-program Woredas over the two survey years. There was a statistically significant increase in the mean calorie intake for households in PSNP Woredas, while households in SLMP and non-program Woredas saw a statistically significant decrease. However, households in AGP Woredas experienced no significant change in their mean calorie intake. As for the mean protein intake, households in PSNP and AGP Woredas registered a statistically significant increase. Conversely, there was a significant decrease in SLMP and non-program Woredas.

Additionally, it is noteworthy that in all cases, the median was consistently lower than the mean, emphasizing the impact of larger extreme values that inflate the mean. This is evident even after modifying the largest 1 percent of data points to the 99th percentile to mitigate the influence of these extreme values on the mean.

Thus, the results for dietary intake by program Woreda between 2021 and 2023 show that while calorie and protein intake have increased for households in PSNP Woredas, protein intake showed an increase for AGP Woredas. On the other hand, there was a decline in calorie and protein intake for households in SLMP and non-program Woredas.

Table 5.3. Dietary intake per adult equivalent per day by program Woreda and survey year

		2021			2023			
	Participation	Median (1)	Mean (2)	Std Dev (3)	Median (4)	Mean (5)	Std Dev (6)	Diff. (5-2)
Calorie (kcal)	PSNP	1565.2	1898.5	1506.9	1683.0	2064.9	1358.8	166.4**
	AGP	1700.5	2119.4	1312.9	1792.2	2051.9	1329.3	-67.5
	SLMP	1700.3	1979.6	1435.4	1478.9	1708.8	1141.8	-270.8***
	Non-program	2033.6	2300.4	1371.1	1637.4	1967.0	1248.5	-333.5***
Protein (gms)	PSNP	57.4	74.0	63.0	67.2	84.3	65.3	10.3***
	AGP	65.5	80.2	52.1	76.4	88.7	60.7	8.5**
	SLMP	57.6	73.3	65.6	50.0	61.0	51.5	-12.4***
	Non-program	81.3	87.4	52.1	60.9	78.8	60.2	-8.6**

Source: Own computation based on RCC Survey 2021 and 2023

5.2 Expenditures on food and non-food items[3]

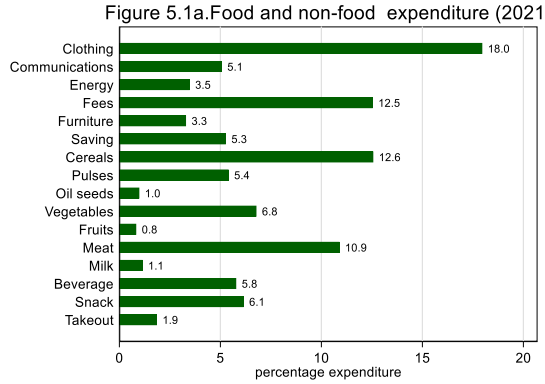
Figure 5.1 illustrates the annual average household expenditure percentages for both food and non-food items, based on the 16 categories outlined in the questionnaire, contrasting the data from the two survey rounds. For non-food expenses, clothing, fees and contributions, and savings deposits are the top three expenditure categories. On the food side, the major spending areas are cereals, meat, and vegetables. In contrast, the least expenditures in the food category are on fruits, milk and eggs, and oil crops, accounting for 0.8 percent, 1 percent, and 1.1 percent

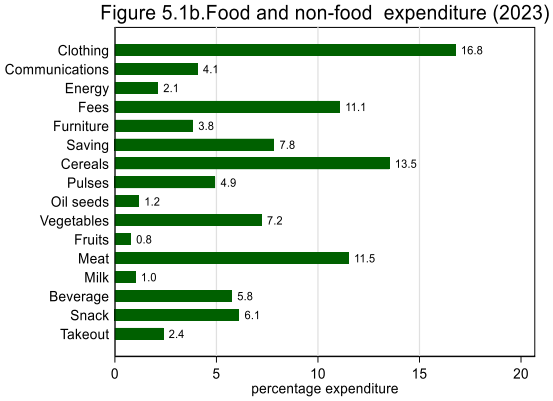
[3] The discussion throughout the next two subsections summarizes key results from the 2023 RCC survey (referred to as round 2 henceforth) and provides comparisons with results in the 2021 RCC survey (referred to as round 1 henceforth).

respectively. These percentages are notably different when compared to the minimal expenditure percentages for non-food items like energy, furniture, and communications.

Comparing the expenditure trends between the two survey rounds indicates that the spending patterns are largely consistent.

Figure 5.1. Food and non-food expenditure shares by survey year





Source: Own computation based on RCC Survey 2021

Source: Own computation based on RCC Survey 2023

Spending on non-food items significantly surpasses that on food items, on a per adult equivalent basis. Non-food expenses claim a more substantial share compared to food expenses. In 2021, expenditure on cereals was notably high, making it the top food expense. This was followed by meat. When compared to spending on vegetables, which ranks third in terms of food expenditure across the years, the outlay for fruits is notably low, being the least on average.

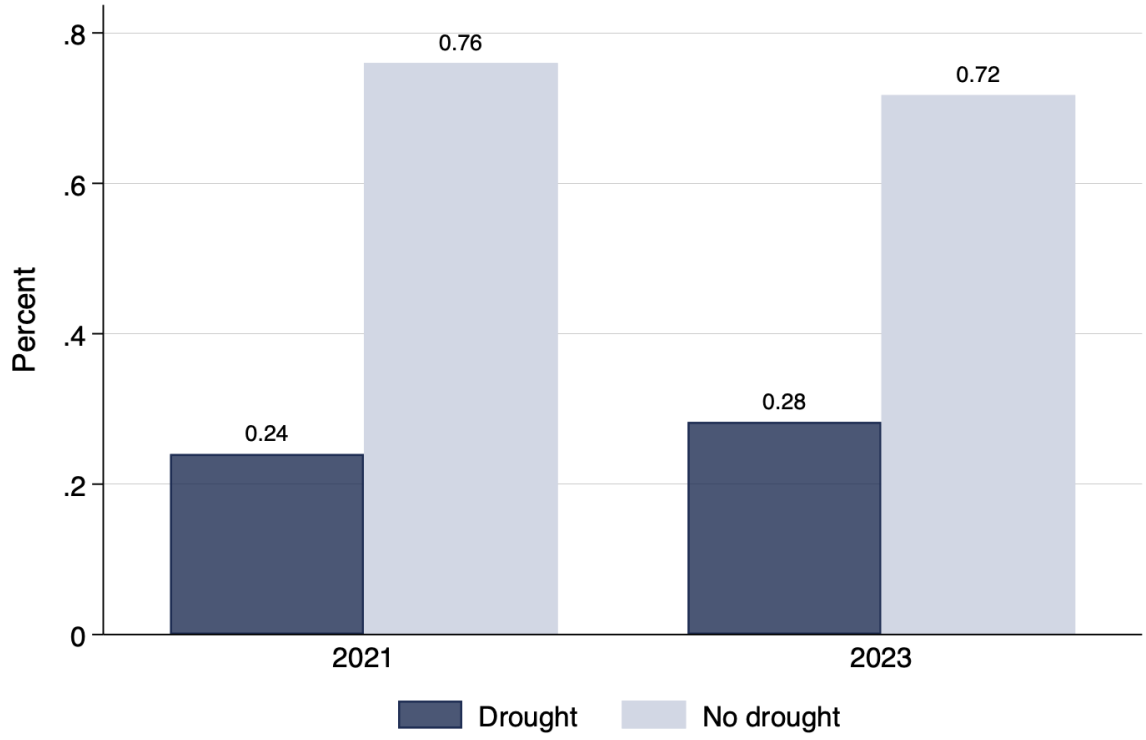
Analysing the data from the two survey rounds, it is evident that the expenditure patterns for food and non-food items remain largely consistent. Non-food item expenditures consistently overshadow those of food, with spending on cereals standing out prominently within the food expenditure category. The categories that occupy smaller and larger shares of spending remain relatively unchanged.

CHAPTER 6: DROUGHT EXPOSURE AND RESILIENCE CAPACITIES

6.1 Drought exposure

Figure 6.1 provides an overview of the occurrence and frequency of drought based on data from the two survey rounds. When households were asked if they had encountered drought in the five years before the first survey round, 24 percent affirmed this. Comparing these results with the second survey, there is a slight increase in the reported incidence of drought.

Figure 6.1. Drought Exposure in the Last Five Years

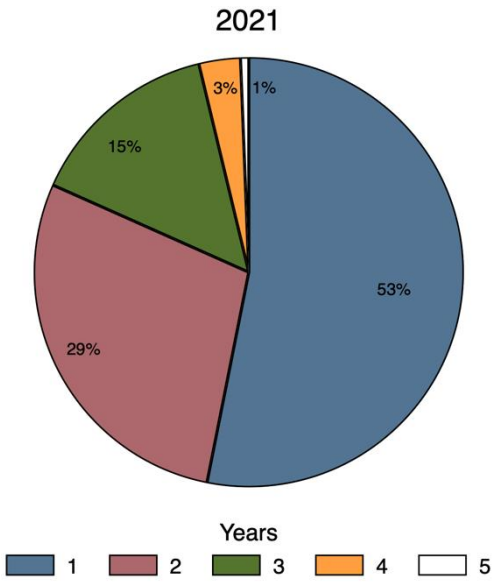
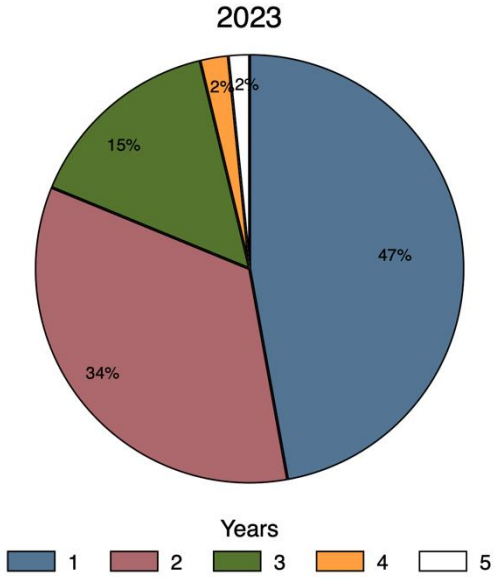


Source: Own computation based on RCC Survey 2021 and 2023

Figure 6.2 shows number of drought in the five years before each of the two survey rounds. Figure 6.2a for the year 2021 shows that a majority, 53 percent of the households, faced drought only once in the said period. In contrast, 29 percent experienced it twice and 15 percent thrice over the past five years. A smaller fraction, constituting 4 percent of respondent households,

reported facing drought four or five times within that timeframe. The pattern observed in round 1 (Figure 6.2a) closely mirrors that of round 2 (Figure 6.2b).

Figure 6.2. Number of droughts in the last five years

a.	b.
	
Source: Own computation based on RCC Survey 2021	*Source: Own computation based on RCC Survey 2023*

The ranking of droughts by severity between 2014/15 and 2020/21 reported in the first round survey is illustrated in Figure 6.3a. The first and second most severe droughts were reported more frequently for the year 2019/20 while the third most severe drought was reported for the year 2020/21 (Figure 6.3a). For the second survey round, the most severe, the second most severe and the third most severe droughts were most frequently reported for the year 2021/22 (Figure 6.3b).

Figure 6.3. Drought severity, percent of households reporting by year

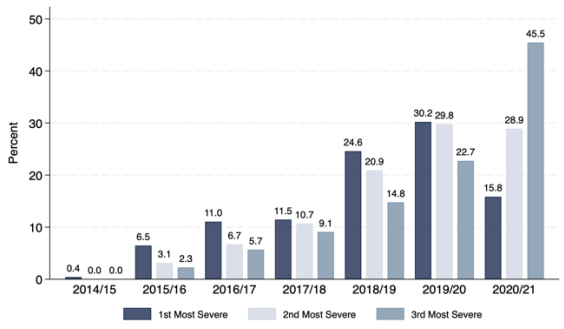
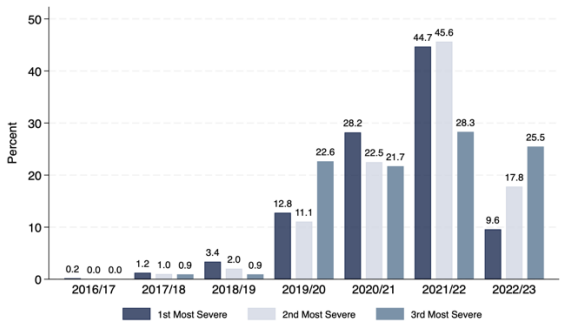
6.3a (2021 survey)	6.3b (2023 survey)
	
Source: Own computation based on RCC Survey 2021	*Source: Own computation based on RCC Survey 2023*

Table 6.1 details the most commonly reported impacts of drought, which include crop loss, livestock death, livestock migration, family migration, and livestock disease. In the first round of the survey, 633 households identified as being affected by drought. According to the 2021 results, crop production is the primary casualty of drought, with 70 percent of drought-affected households reporting crop loss. The next most reported impact is livestock death, experienced by 22 percent of these households. Livestock migration, as a result of drought, is reported by only 3 percent of affected households. This relatively low figure might be attributed to the extensive nature of the drought, impacting vast areas, making livestock migration a less viable adjustment option. Human migration due to drought is even rarer, with only 1 percent of the affected households reporting such an event. Table 6.1 further suggests that livestock disease is an infrequent consequence of drought, as only 3 percent of households reported their livestock suffering from drought-induced ailments. This aligns with observational data suggesting that livestock often becomes severely weakened before perishing, primarily due to a lack of food and water.

In comparing the results from the two rounds, a slightly larger number of households (800) reported being affected by drought in the second round. The pattern of drought impacts remains consistent between the two rounds, with crop loss and livestock death being the most commonly reported effects. Human migration follows these in terms of impact. Both livestock

and family relocation are low-impact outcomes in both rounds. Quantitatively speaking, the second round saw a greater percentage of households reporting crop loss compared to the first round, while the opposite is true for livestock death. Livestock disease, and both human and livestock migration are marginally higher in the first round compared to the second, with these impacts being almost negligible in the latter round.

Table 6.1. Effect of drought on livestock owners in the past five years

	2021		2023		
	Mean	Std. Err.	Mean	Std. Err.	Mean diff.
Crop loss	0.70	0.02	0.89	0.01	-0.19***
Death of livestock	0.22	0.02	0.08	0.01	0.14***
Livestock migration	0.03	0.01	0.02	0.01	0.00
Human migration	0.01	0.00	0.01	0.00	0.00
Livestock disease	0.03	0.01	0.02	0.01	0.00

Source: Own computation based on RCC survey 2021 and 2023. n =633

6.2 Resilience in the face of drought

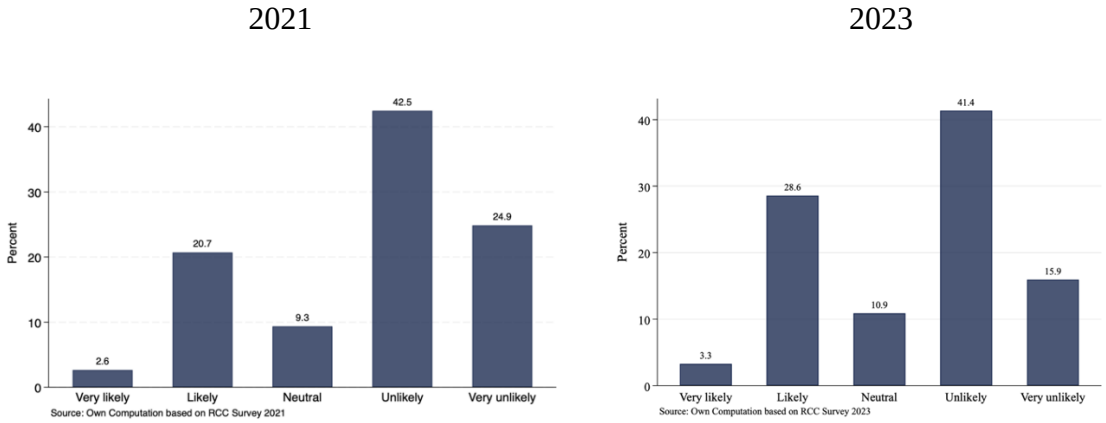
This section focuses on assessing the resilience of households in the face of a drought shock. The level of household resilience in the face of an adverse shock depends not only on the frequency and severity of the shock but also on the household's socio-economic capacities. This aligns with the current practice in the literature where resilience is framed as a multidimensional concept comprising different household capacities – mainly absorptive, adaptive, transformative, and anticipatory. In our survey, respondents were asked both subjective and objective questions, which could capture the different aspects of household resilience capacities. In what follows, we present descriptive statistics on these different dimensions of resilience capacities, linking them to drought exposure, and comparing them between the survey rounds.

6.2.1 Resilience capacity: Absorptive

The first type of resilience capacity is absorptive, which refers to the short-term ability to reduce the immediate impact of an adverse shock on their livelihood. Examples of absorptive capacities include financial support from family and friends, access to formal credit, borrowing from others, and the availability of financial savings. Such aspects help rural households

withstand shocks in the short- and medium-term. The results from the two survey rounds are presented below. In Figure 6.4, respondents were asked about the likelihood that their households would recover (bounce back) from damage within six months if a drought occurred.

Figure 6.4. Likelihood of recovering from drought damage within six months, by year

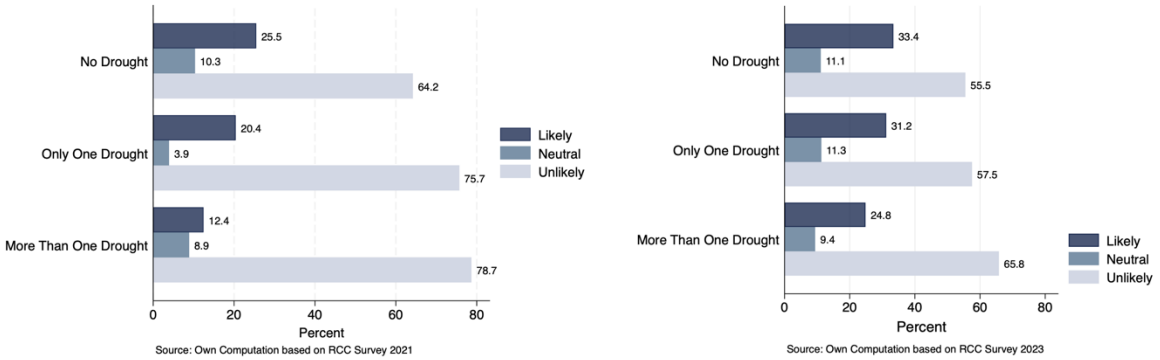


Source: Own computation based on RCC survey 2021 and 2023. n =633

Overall, respondents indicating it is likely increased from about 20 percent to 29 percent, and those indicating it is very unlikely decreased from 25 percent to 16 percent, compared to the RCC Survey 2021. In total, those indicating that they would likely recover within six months rose to roughly 32 percent, compared to those indicating it's unlikely, which totals about 57 percent. This indicates that the majority is still unlikely to recover. However, compared to the RCC Survey 2021, this proportion has decreased from 67 percent.

Figure 6.5 illustrates the perceived probability of recovering from drought damage within six months, categorized by the number of years they experienced drought in the previous five years.

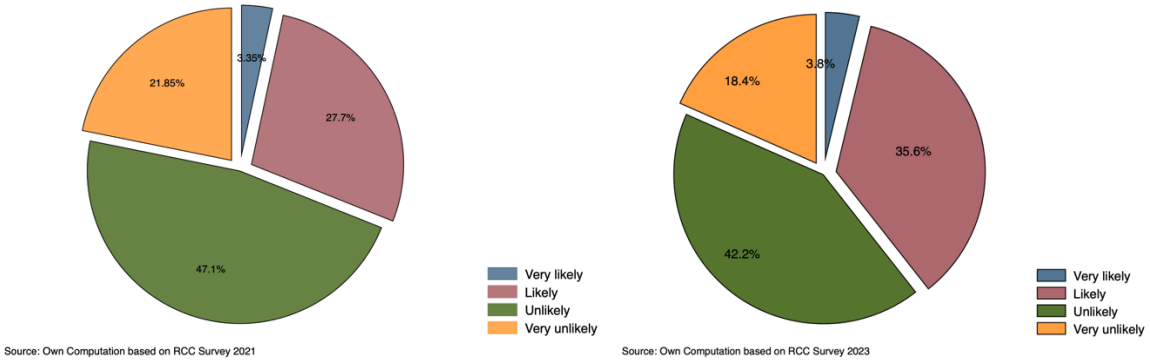
Figure 6.5. Likelihood of recovering from drought damage within six months, by number of droughts



Between the survey rounds, the proportion of households expressing that they would likely recover from drought damage within six months rose for those who experienced no droughts, a single drought, and multiple droughts. Concurrently, the households stating they were unlikely to recover decreased from the first to the second round, regardless of whether they experienced a drought and, if so, its frequency. In summary, households perceive an increased likelihood of recovering from drought damage within half a year. Notably, the most significant rise in this perception is among those who faced more than one drought in the past five years.

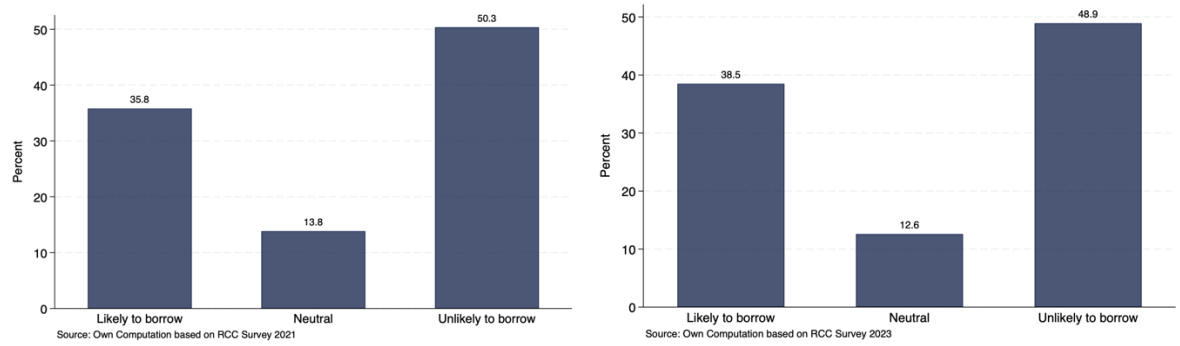
From Figure 6.6, it is evident that approximately 36 percent of respondents believe they are likely to depend on family or friends during a drought. In comparison to the first RCC survey in 2021, this figure has risen from about 28 percent. Additionally, the proportion of those stating they are unlikely to lean on family or friends has dropped from 47 to 42 percent between the two survey rounds. This could indicate a growing propensity among individuals to rely on, or become more dependent upon, family or friends when confronted with drought conditions.

Figure 6.6. Relying on family and friends during drought



One element of absorptive capacity revolves around procuring financial resources. Within the survey, participants were asked about their dependency on family and friends, as well as their capacity to borrow from others. Figure 6.7 illustrates the probability of respondents borrowing from others when confronted with a drought-induced setback. The likelihood of households borrowing from others saw a slight uptake compared to the first RCC Survey in 2021, moving from 35.8 percent to 38.5 percent. The fraction of respondents indicating "neutral" dipped a bit, and a similar decline was observed for those marking "unlikely."

Figure 6.7. Likelihood to borrow from others in the face of a drought shock



Source: Own computation based on RCC survey 2021 and 2023. n =633

6.2.2 Resilience capacity: Adaptive

The second facet of resilience is adaptive capacity, which points to a longer-term ability to adapt by learning from past shocks. Adaptive capacity remains a foundational element of resilience because it tends to foster a resilience that is more sustainable compared to short-term mechanisms. To gauge households' perceptions of adaptive capacity, survey participants were prompted to indicate how equipped their household would be to adapt to challenges posed by drought if the severity and regularity of such drought events intensified in the future. In Table 6.2, we evaluate whether households' views on adaptive capacities are influenced by the gender and educational background of the household head.

Table 6.2. Likelihood to adapt to drought-induced threats, by gender and education level of household head

	Likely to adapt	Neutral	Unlikely to adapt
Male	27.16	11.90	60.93
Female	24.33	11.90	63.77
Illiterate	23.31	9.77	66.92
Primary	24.13	13.29	62.59
Secondary and above	29.63	7.41	62.96

Source: Own computation based on RCC Survey 2023

Notably, when comparing with the RCC Survey 2021, households where the household head possesses an education level of secondary or above are still most likely to adapt, registering at 29.6 percent, in contrast to those with primary or illiterate education levels. This disparity has, however, shrunk between the two survey rounds. For households in which the household head is illiterate, 67 percent expressed that they are unlikely to adapt, mirroring the findings from RCC Survey 2021.

When examining the gender of the household head, similar patterns emerge between the rounds. Male-headed households tend to be more optimistic about adapting, whereas female-headed households are less confident. Among male-headed households, 17.6 percent believe they would likely adapt if the intensity and frequency of drought-induced threats escalated in

the future. In contrast, for female-headed households, this figure stands at 12 percent, with a substantial 75.4 percent indicating that they would be unlikely to adapt.

6.2.3 Resilience capacity: Anticipatory

The third component of resilience capacity is the anticipatory aspect, which refers to the ability to foresee climate shocks before they occur. This is partly achieved by learning from past shocks, early warning systems, or short-term weather forecast information. In the survey, respondents were asked how likely it was that they were fully prepared in advance if a drought were to happen soon. In what follows we present results between the two survey rounds.

Dividing the responses by the number of droughts faced in the past five years, as seen in Table 6.3, shows that households exposed to a drought at least once in the last five years are more likely to be prepared compared to households that faced no drought in the same period. This could suggest that experiencing a drought makes households more likely to be prepared for another drought. However, such conclusions cannot be drawn with certainty. Moreover, as the number of droughts faced increases, so does the likelihood of being fully prepared. When comparing the statistics in Table 6.3 with those from the RCC Survey 2021, the percentages in "likely prepared" are overall higher, and the percentages in "unlikely prepared" are lower.

Table 6.3. Preparedness for future drought-induced threats, by frequency of droughts faced in the past five years

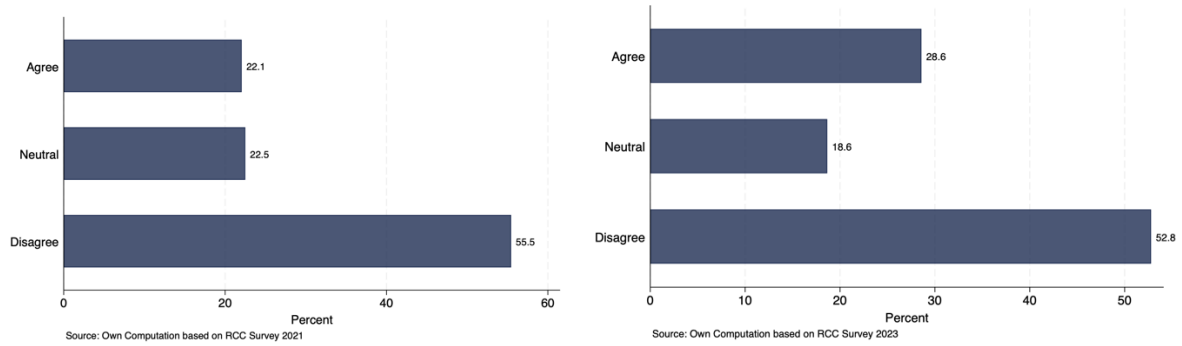
	Likely prepared	Neutral	Unlikely prepared
Number of droughts=0	21.9	12.8	65.3
Number of droughts=1	25.3	12.4	62.0
Number of droughts=2	13.5	19.3	67.2
Number of droughts=3	7.06	15.3	77.6
Number of droughts=4	0.0	0.0	100.0
Number of droughts=5	0.0	0.0	100.0

Source: Own computation based on RCC Survey 2023

Figure 6.8 displays the responses of households between the survey rounds when asked if they agreed with the statement, "Your household has learned important lessons from past droughts

and is fully prepared for a drought event that may occur in the future." Compared to the first RCC Survey in 2021, a smaller proportion of respondents in 2023 disagreed that they had learned from past droughts, decreasing from 48 percent to 40 percent. Thus, more respondents feel they have learned from past droughts, potentially indicating a heightened sense of learning and increased anticipatory resilience capacity. Correspondingly, the proportion of respondents agreeing with the statement has risen from 18 to 26 percent since the first RCC survey in 2021.

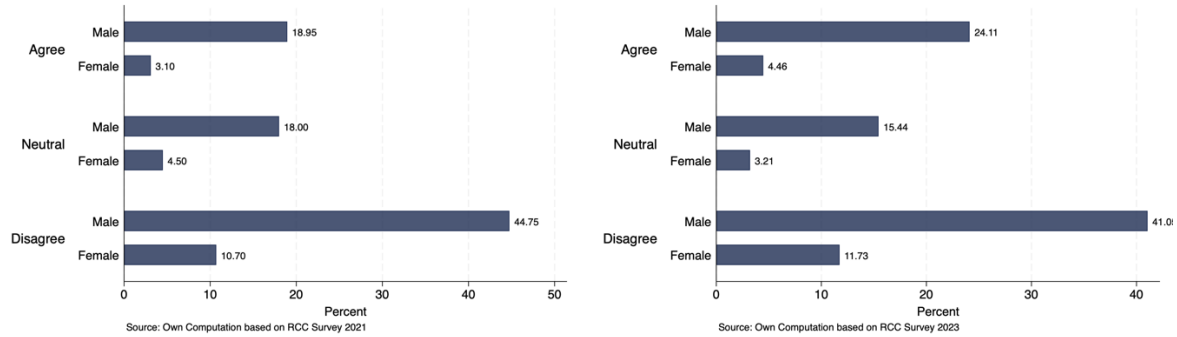
Figure 6.8. Households learned lessons from past droughts



Source: Own computation based on RCC survey 2021 and 2023. n =633

In Figure 6.9 we can see that by sorting the households' perceptions based on the gender of the household head, male-headed households were more likely to agree to the statement that their household had learnt important lessons. These statistics are similar in comparison with the RCC Survey 2021, where the difference in the responses indicating "agree" by male- and female-headed houses have decreased in 2023.

Figure 6.9. Households' lessons from past droughts, by gender of the household head



Source: Own computation based on RCC survey 2021 and 2023. n =633

6.2.4 Resilience capacity: Transformative

The final dimension of resilience is transformative capacity. This encompasses longer-term aspects such as changes at the system level, modifications in social structures, or alterations in policies or institutions. Subsequent figures present the results from both survey rounds.

To gauge their perceptions of transformative capacity, households were asked about the likelihood of altering their source of income or livelihood in the event of a drought. Descriptive statistics of the responses are displayed in Figure 6.10. Compared to the RCC Survey 2021, the number of households indicating they would likely change increased from about 19 percent to 26 percent in 2023. Meanwhile, respondents who remained neutral decreased, while the percentage of households unlikely to change stayed consistent.

Figure 6.10. Likelihood of households changing source of income or livelihood if drought occurs

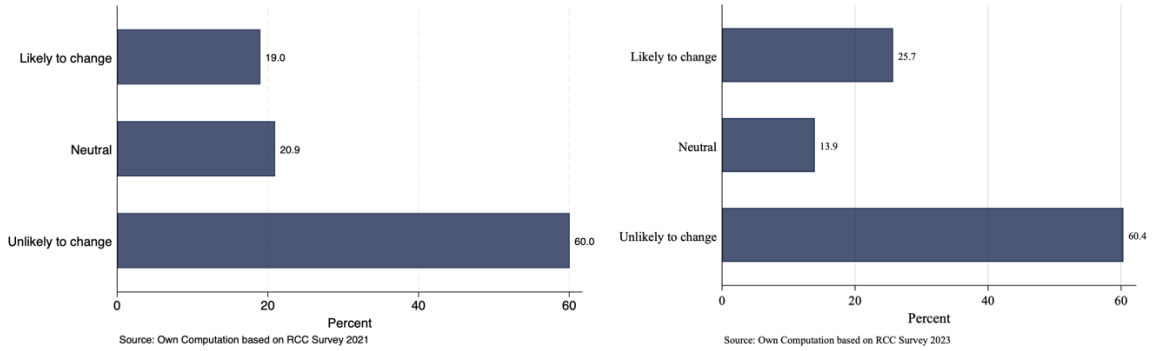


Figure 6.11 shows that most households indicated that they are unlikely to change their primary source of income if a drought occurred in the future. This is similar to what the households responded in the RCC Survey 2021. Out of those households indicating they are likely to change primary source of income, both male and female respondents are more likely to change, compared to the RCC Survey 2021.

Figure 6.11. Likelihood of households changing source of income or livelihood if drought occurs, by sex of household head

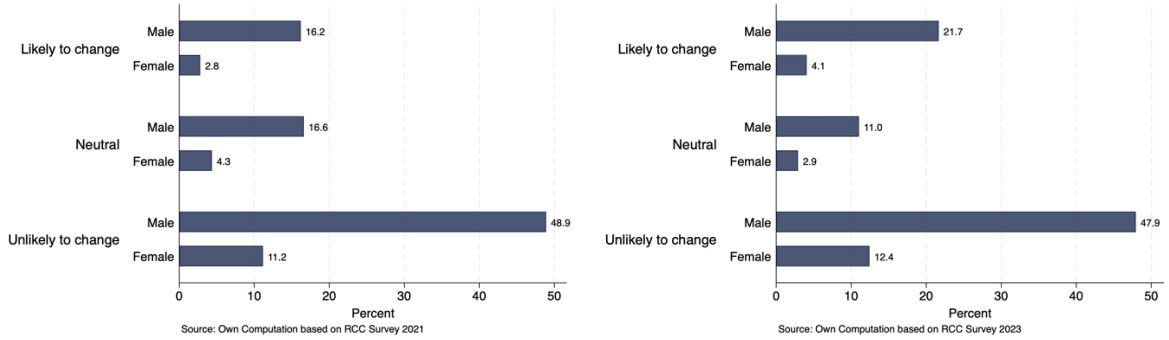
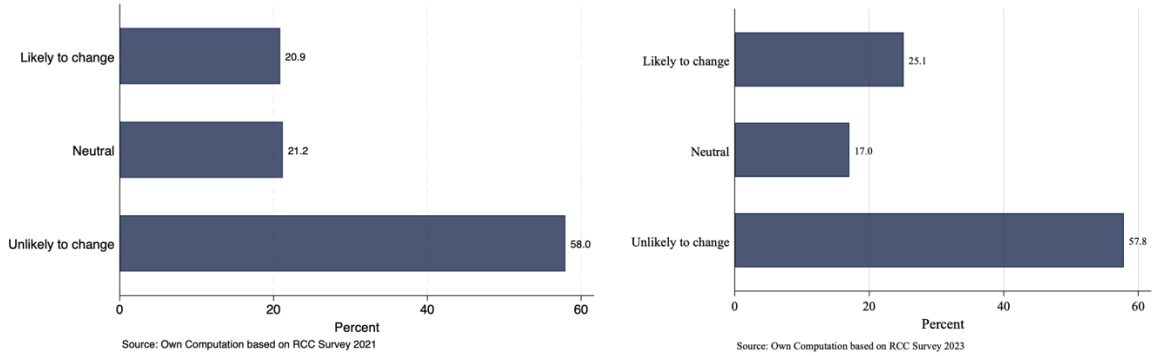


Figure 6.12 shows that the majority of households disagree with the statement that they can successfully adapt to a drought-induced threat, even if it necessitates a change in their way of life. Between the two survey rounds, the proportion of household indicating “likely to change” has increased slightly, while those respondents indicating “neutral” has decreased.

Figure 6.12. Adaptation to a drought-induced threat by changing way of life



Comparing the numbers in Table 6.4 to the results from the RCC Survey 2021 (seen in Table 6.5), we observe an increase in the proportion of respondents who indicated they would likely change their way of life in response to a drought-induced threat across all education level groups.

Table 6.4. Adaptation to a drought-induced threat by changing way of life, by education level and gender

	Likely to Change	Neutral	Unlikely to Change
Illiterate	22.93	18.05	59.02
Primary	26.22	15.73	58.04
Secondary or above	29.63	14.81	55.56
Male	26.19	17.86	55.95
Female	24.97	16.18	58.84

Source: Own computation based on RCC Survey 2023

For households where the head has an illiterate education level, this proportion rose from about 18 percent in 2021 to almost 23 percent in 2023. For those with a secondary or higher education level, this figure climbed from 22 percent to almost 30 percent. These findings shown in Table 6.4 and 6.5 generally suggest that, based on our sample, respondents are increasingly inclined to consider altering their way of life. Nevertheless, the percentages of respondents indicating neutrality or an unlikelihood to change remained fairly consistent between the two years.

Table 6.5. Adaptation to a drought-induced threat by changing way of life, by education level and gender

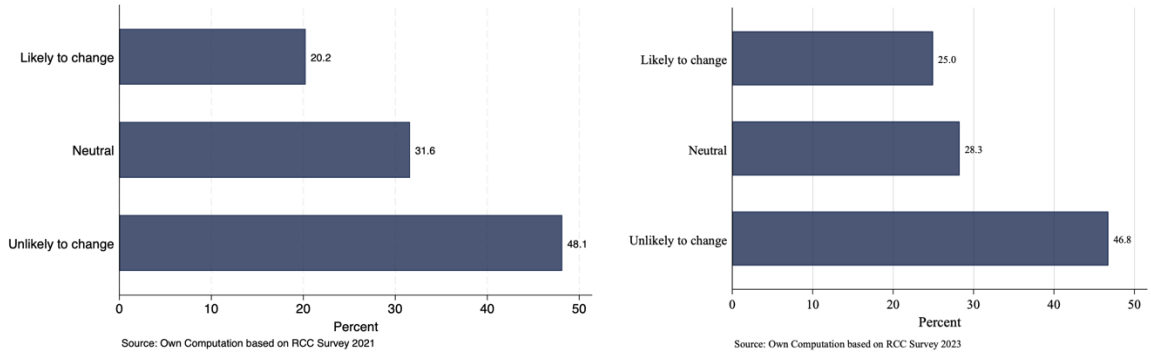
	Likely to Change	Neutral	Unlikely to Change
Illiterate	18.38	21.83	59.80
Primary	27.03	23.17	49.81
Secondary or above	24.14	10.34	65.52
Male	22.28	20.44	57.28
Female	14.48	24.59	60.93

Source: Own computation based on RCC Survey 2021

When examining male- and female-headed households, there is a noticeable uptake in respondents indicating a likelihood to change their lifestyle. For both male and female households, approximately 26 percent and 25 percent respectively reported this inclination, representing an increase compared to the RCC Survey 2021.

In Figure 6.13, the adaptation of households to threats by transitioning from a pastoralist to a sedentary system across the two survey rounds is illustrated between the survey years.

Figure 6.13. Adaptation to threat by changing from pastoralist to sedentary system



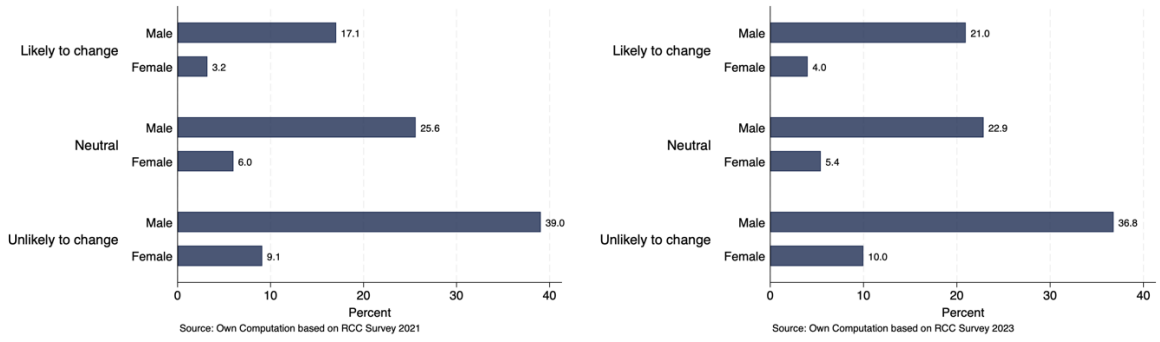
We show that the proportion of households suggesting a potential shift from their pastoralist system to a sedentary one stands at 25 percent. This marks an increase of about 5 percentage points when contrasted with the RCC Survey 2021. Such data might indicate that households

are becoming more inclined to modify their systems as a means to adapt to, or confront, future drought-induced challenges. Concurrently, the percentage of households expressing reluctance toward such a change remains relatively consistent, hovering around 47 percent.

When disaggregating by education level and the gender of the household head, it is clear that the discrepancies between male- and female-headed households are minimal. Compared to the RCC Survey 2021, these differences have marginally narrowed. Concerning education level, all categories show a leaning towards the unlikelihood of transitioning their livelihood farming system from pastoralist to sedentary. This sentiment was similarly reflected in the RCC Survey 2021, though the differences then were notably less pronounced.

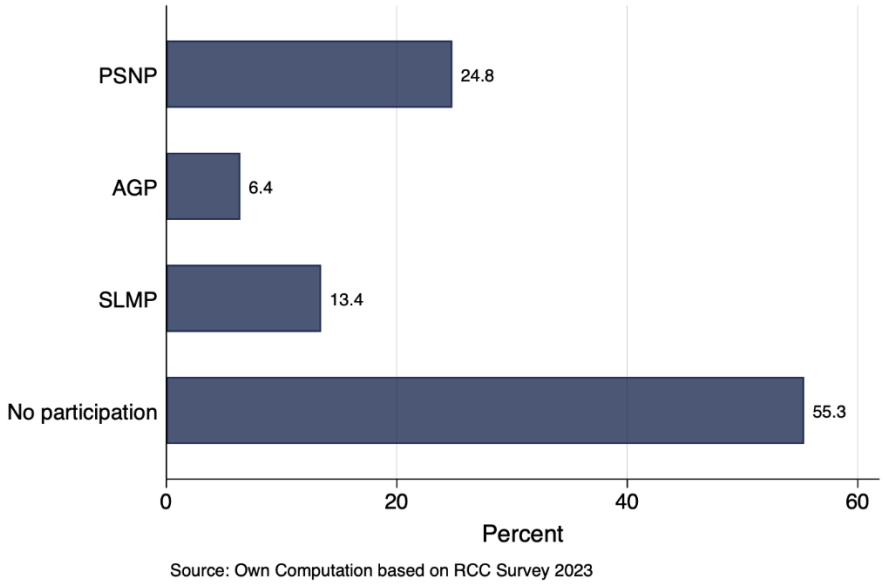
In Figure 6.14, we show the adaptation to threat by changing from a pastoralist to a sedentary system between the two survey rounds, divided by the sex of household head. From the results, we can see an increased gender gap of those household heads who indicate that they are likely to change system, while for those indicating they are unlikely to change system, the gender gap decreased. Summarily, households are still unlikely to change their primary source of income, way of life, or livelihood farming system to adapt to future drought-induced threats. This suggests that the transformative capacity of households in the sample remains at a low level.

Figure 6.14. Adaption to threat by changing from pastoralist to sedentary system, by gender of household head



Importantly, a central component of transformative capacity is the support provided by the government. To capture this, the households were asked about their involvement in these government programs, Figure 6.15 displays the percentage of participants in each government program.

Figure 6.15. Overall participation in government programmes



Of the households with at least one member participating in a government program, around 25 percent had participated in the PSNP program, a figure that is nearly identical to that in the first RCC Survey 2021 round. For household participants in AGP, the numbers for the second round in 2023 are higher than in 2021, 6.4 percent compared to 4 percent. For SLMP, the percentage of households participating in 2021 was 20 percent, which signifies a decrease in 2023 to about 13 percent.

CHAPTER 7: SUMMARY

Summarily, the main insights and learning of the second round of the RCC Survey 2023, and a few points on this report's policy implications, is presented below. The main purpose of the second survey round is to compare how the results of the first round might have changed, particularly looking at household resilience and coping strategies, and how the findings can inform policy.

Our findings show that, in general, households report an increased likelihood of recovering from drought damage within six months. This increase is observed regardless of whether households had experienced no droughts, only one drought, or more than one drought in the last five years, but it was especially strong among those who have faced multiple droughts over the last five years. Approximately 32 percent of sample respondents believe they would likely recover within six months from a setback, compared to 57 percent who feel they would not. Although the majority remains pessimistic about recovery, optimism has grown since the RCC Survey 2021, where 67 percent felt recovery was unlikely. At the same time, we observed that households are more likely to rely on, or become more dependent upon, family or friends when confronted with drought conditions. Whether this tendency is related to the increased likelihood of recovering from drought damage within six months of a shock is difficult to ascertain.

Based on our sample, the respondents indicated that they had learned from past droughts and are now more prepared for future ones. This suggests a growing sentiment of learning and an enhanced anticipatory resilience capacity. A contrasting trend is shown for the transformative capacity. We see that households are unlikely to change their primary source of income, way of life, or livelihood farming system to adapt to future drought-induced threats, despite a slight tendency in the sample of increased consideration among the respondents of changing way of life or alternative income sources. The respondents indicating that at least one member of the household had participated in a government program remained relatively the same between the survey rounds, with participation in SLMP decreased from 20 to 13 percent in 2023.

One of the main findings of the second survey round regarding demographic household characteristics is that approximately 80 percent of the household heads were male and 50 percent were illiterate, with fewer than 10 percent having completed education beyond secondary school or an adult literacy program. Notably, from the first to the second survey round, there was a rise in the percentage of household heads and members with education levels surpassing primary school. Simultaneously, between the survey rounds, there has been a reduction in the percentage of illiterate household heads and members. Moreover, we can see that in the sample, the households' source of electricity is increasingly coming from solar power or connections through the available grid. Another change between the survey rounds has been the decrease in respondents who reported having no electricity.

While the Ethiopian government promotes irrigation use among smallholder farmers, the data reveals a contrasting trend. The number of households employing irrigation dropped from 295 in 2021 to 258 in 2023, equivalent to a decline of roughly 12.5 percent. Relatedly, we find that the proportion of individuals, who received training on irrigation rose from 13.7 percent in 2021 to 17.4 percent in 2023, signifying a positive shift. Another notable coping mechanism is the sale of livestock to mitigate drought effects.

The study shows a decline in households reporting good availability of improved water sources for their livestock in 2023 compared to 2021. Over the span of both surveys, farm households predominantly utilized services such as fertilizer application, modern seed varieties, and pest and disease control. Encouragingly, there was an increase in the number of households using pest and disease control services due to climate change concerns. Additionally, more households engaged with extension services to adopt sustainable agricultural and water-management practices, highlighting the growing significance of these services in climate change adaptation. For instance, the percentage of households growing trees, the number of trees grown, and the revenue generated from grown trees in 2023 are statistically significantly higher compared to 2021. This indicate the increased attention to growing and integrating trees and permanent crops with annual crop production to provide shade, a steady supply of food and/or income throughout the year, arrest degradation, maintain soil fertility, diversify income sources, enhance the efficient use of soil nutrients, water, and radiation, and provide regular employment.

In the sample, only 581 households (approximately 30 percent) engaged in off-farm activities, highlighting that involvement in rural enterprises is constrained. However, there is a slight increase in participation compared to the first survey conducted in 2021, where only 499 households participated in these activities. Notably, off-farm enterprises operating for just one month increased from 1.4 percent to 2.6 percent. In contrast, those in operation for four months dropped from 8.8 percent to 6.7 percent during the second survey. There was a notable surge in the number of households providing transport services, rising from 19 to 57 households between the survey rounds. This suggests that transport services, especially using motorcycles and Bajajs, are becoming more profitable ventures in rural Ethiopia.

With regard to dietary habits, despite the fact that there was a general increase in the average number of food groups consumed by households, there are variations in specific food categories. The percentage of households consuming at least one food item increased for pulses, meat, and fish, while it decreased for oilseeds, tubers, and stems. Analysing dietary intake by program Woreda between 2021 and 2023 reveals that calorie and protein intake increased for households in PSNP Woredas. Concurrently, AGP Woredas saw a rise in protein intake.

Our findings reveal that despite the Ethiopian government's efforts to promote irrigation use, the number of households employing irrigation declined with 12.5 percent, which points to the need to pay adequate attention to irrigation, given that irrigation use is one of the climate smart agriculture and a long run investment to resilience to drought and climate change.

Moreover, a key area of importance for policymakers is a combined and integrated adoption of modern agricultural technologies (fertilizer, improved seeds, agrochemicals, and irrigation together); this would increase productivity gain and lead to improved resilience for households. Adding promotion of growing trees to such policy could assist in increasing resilience and income levels for households. Further, as the adoption rate for agricultural technologies is shown to be higher in AGP-woredas, policies that would enhance or extend the AGP could assist in increasing productivity gain and resilience. Improving or extending the AGP government programme could also assist in increasing the transformative capacity as it is an institutional change that can help households' long-term transformation to more resilient households.

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