Building Resilience to Climate Change in Ethiopia

Household Survey Report

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

January 2022

Table of Contents

List of Tables

List of Figures

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
SNNPR	Southern Nations, Nationalities and Peoples' Region
UCPH	University of Copenhagen

Foreword and Acknowledgments

This study is a key output of the research and capacity-building project entitled ‘Building Resilience to Climate Change in Ethiopia’, which is 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 members of the research team, who contributed to this report, include:

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The research team would like to express our sincere appreciation to Danida for financial support and to the Danida Fellowship Centre (DFC) for effective engagement in the planning, implementation, and monitoring of our work, which was carried out during a period when the Covid-19 global pandemic affected our ability to travel and carry out a number of planned activities.

Despite the Covid-19 challenges, we managed to implement the survey largely in line with our original research plan and design, respecting its principles. This is, in very large measure, due to the commitment and impressive work efforts of 11 survey supervisors, 40 enumerators, survey coordinators, and data managers and the willingness of some 2,000 rural households to engage with our team and share their insights about the conditions under which they live and try to secure

their livelihoods. We would particularly like to thank the Ministry of Agriculture (MoA), the Regional Bureau of Agriculture (RBoA) of the respective regions, the local administration at district level and below, PSNP/SLMP/AGP implementation committee members in the survey districts, and Farmer's Associations, which all performed a great facilitation role throughout the process. We would also like to extend our appreciation to the field staff engaged as supervisors, enumerators, coordinators, and data managers for their dedication and commitment to engaging despite all the challenges.

Our sincere appreciation also goes to the PSI leadership, including Professor Beyene Petros (Executive Director), Teferi Tiyaru and Alebele Dessie (Vice Directors) for their guidance and continuous support. Similarly, to the Head of the UCPH Department of Economics, Professor Christian Schultz, and all the UCPH support staff, without whose continuous commitment our work would have been impossible. Finally, Lesley Ellen (freelance copy-editor and proofreader) helped improve the manuscript of this report with her most effective copy-editing.

The Research Team
Copenhagen and Addis Ababa,
8 January 2022

Executive Summary

Introduction

Climate induced hazards such as droughts, pose a major threat to the conditions of the rural households in Ethiopia. With the livelihood of the vast majority relying on the traditional agricultural, which is highly vulnerable to recurrent climate related hazards, coupled with a population growth rate of around 2.5% per year, Ethiopia needs to adapt to climate change and achieve significant increases in agricultural productivity over the next decades. In the past, severe droughts in Ethiopia have led to widespread famines. The country experienced 15 drought episodes between 1965 and 2015, some of which resulted in massive humanitarian crises. For instance, in 2015-2016 the country experienced one of the worst El Niño-induced droughts in decades, with below-average rainfall leading to 50–90% harvest failure affecting more than 10.2 million people, who became dependent on food assistance.

On this background, shielding the economy from severe climate shocks and building resilience to climate change induced shocks is an urgent policy priority for Ethiopia. It is with this sense of imperative need that the government of Ethiopia is taking proactive action to address climate change associated challenges. The launch of the Climate Resilient and Green Economy Strategy (CRGE) in 2011, which includes improving resilience to climate change as one of its main objectives is a clear indication in this regard. The inclusion of CRGE as one of the cross-cutting components of the country's current growth and transformation plan (GTP II), also shows the government's commitment to address climate change related issues. The GTP II acknowledges that in the long-term, if climate change is not tackled, growth and economic development itself will be at risk. This accentuates the need for concrete action to reduce vulnerability and increase resilience in the face of adverse climate shocks.

It is with this understanding that the Policy Studies Institute (PSI) together with the Development Economics Research Group at the University of Copenhagen (UCPH-DERG) started a collaborative research project supported financially by Danida on building resilience to climate change with the aim of providing a sound evidence base to help design future resilience enhancing policies in the country. In particular, the objective is to identify, compare and evaluate the drivers of resilience to climate change in rural Ethiopia by examining actions taken at the household and

village/district level as well as analyzing the effects of large-scale flagship programmes. They include the Ethiopian Productive Safety Net Programme (PSNP), the Sustainable Land Management Programme (SLMP), and the Agricultural Growth Programme (AGP). This is done using existing national survey data, satellite measures of drought exposure and vegetation resilience, and a new, targeted household survey in rural Ethiopia, which is the topic of the present report.

The Household Survey

The Resilience to Climate Change (RCC) household survey consists of interviews with 2,000 households across three agro-ecological zones in five regional states: Amhara, Oromia, Somali, Gambela and the Southern Nations, Nationalities and Peoples' Region (SNNPR), and two towns. The Survey covered 40 Woredas drawn from the five regional states and one City administration (Dire Dawa). As the survey is also designed to enable assessment of the contributions of the three major national flagship programmes: PSNP, SLMP and AGP, 31 out of the 40 Woredas are from flagship programme Woredas, while the remaining nine are from non-programme Woredas. We used systematic random sampling to draw 50 households from each Woreda. Inaccessible Woredas and Woredas with a security problem were dropped before sampling.

The sampling strategy used the representativeness of the population as a critical principle. Three stages of sampling were undertaken: drawing sample Woredas, sample Kebeles, and sample households. Woredas were drawn randomly from 12 groups formed by a combination of agro-ecology and programme/non-programme status.

The survey questionnaire includes questions on household composition; agricultural production and technologies, livestock and non-farm activities; wealth and consumption; climate change perception, drought and resilience capacities; risk preferences, time preferences; and guessing-game experiments.

Key Findings

The average household size in our survey is 5.5 individuals, with an almost equal distribution of males and females; however, females head only 18 percent of the households interviewed. Almost half of household heads are illiterate. This has meaningful implication on rural and agricultural community development and resilience building without solid policy actions to address.

In terms of agricultural activity, the households mainly produce cereals, such as maize and teff. However, the households consume a large proportion of these crops, indicating that cereals are less commercialized than cash crops, spices, vegetables, and fruits. In relation to household consumption, cereals and grains are also the most consumed food group and vegetables and fruits are the second least consumed group. Few households engage in non-farm activities, with only about 36 percent selling processed foods and 21 percent selling firewood, homemade charcoal, timber for construction, wooden poles, etc.

Around 24 percent of households reports to have been exposed to at least one drought in the past five years. Adjustment of consumption was the dominant coping strategy when facing a drought, followed by selling livestock. The households generally believe they are unlikely to have the capacity to reduce the immediate impact of drought on their livelihood. With regard to households' perception of the likelihood of recovering from future drought damage, while the likelihood of recovery decreases with the number of droughts, it increases with the level of education of the household head. However, a high proportion of households believe they are unlikely to be able to adapt to future drought-induced threats, and the majority of the households report that they are unlikely to change their primary source of income if a drought occurs in the future. This puts the need for comprehensive policy action in perspective.

Use of extension services, irrigation, and improved seeds is unfortunately relatively rare in both harvest seasons with some exceptions. For example, 52 percent of households in the Amhara region had access to extension services during the Meher season, while 59 percent of their fellow farmers in the Somali region had access to irrigation during the same season. Access to an agricultural extension service is a major potential source of information about agricultural activities and natural resource conservation for farming households. Moreover, the positive effect of extension contacts means that farmers who have contact with extension agents tend to adopt adaptation measures in response to the changing climate. Despite water stress in agriculture being

a global threat, investment in soil water conservation and irrigated agriculture is low. A major challenge is the shortage of irrigation water sources, followed by a lack of motor pumps and conflict in water use. These are therefore all areas where concerted policy action can make a big difference to people's livelihoods, while at the same time helping to adapt to climate change and promote greater resilience at the household level.

CHAPTER 1: INTRODUCTION

HIGHLIGHTS:

- Using a household survey, the research project aimed to identify, evaluate, and compare the drivers of resilience to climate change in rural Ethiopia.

- The survey covered 2,000 households and 40 Woredas from five regional states (Amhara, Oromia, Somali, Gambela and the Southern Nations, Nationalities and Peoples' Region (SNNPR)), and one City administration (Dire Dawa).

- The survey questionnaire comprised questions on household roster; agricultural production and technologies, livestock and non-farm activities; wealth and consumption; climate change perception, drought and resilience capacities; risk preferences, time preferences; and guessing-game experiments.

1.1 Background

With an estimated rural population of more than 85 million who depend on agriculture for their livelihood, Ethiopia needs to adapt to climate change, achieve sustainable increases in agricultural productivity and production, and improve welfare. Considering this, the University of Copenhagen Development Economics Research Group (UCPH-DERG) and the Policy Studies Institute (PSI) of the Ethiopian Government signed a partnership agreement to conduct a five-year research project (April 2019 to March 2024) entitled 'Building Resilience to Climate Change in Ethiopia: Policy Options for Actions', with funding from Danida administered by the Danida Fellowship Centre (DFC).

1.2 Objective of Resilience to Climate Change (RCC) Survey

Despite the increasing incidence of climate-related shocks and hazards, few studies consider resilience building through improved agricultural water management, introducing innovative production technologies, promoting proactive measures rather than taking reactive action, building the capacity of households to withstand shocks, and scaling up innovative

practices used by households to cope with climate change. Indeed, these are areas which require an in-depth understanding of grassroots conditions.

Hence, the overall objective of the research project was to identify the drivers of resilience to climate change in rural Ethiopia. In doing so, we used extensive existing national survey data and satellite measures of drought exposure and vegetation resilience, and we conducted a targeted household survey on resilience-enhancing actions to identify, evaluate, and compare drivers of resilience to climate change in rural Ethiopia. We analysed: (1) actions at the household and district/village level; (2) the effects of large-scale interventions (flagship programmes) including the Ethiopian Productive Safety Net Programme (PSNP), Sustainable Land Management Programme (SLMP), and Agricultural Growth Programme (AGP); and (3) the roles of institutional factors and social networks. Overall, the project aimed to provide a sound evidence base to help design future policies in Ethiopia and beyond.

1.3 Survey Design (Methodology) and Implementation

1.3.1 Sample Size and Coverage

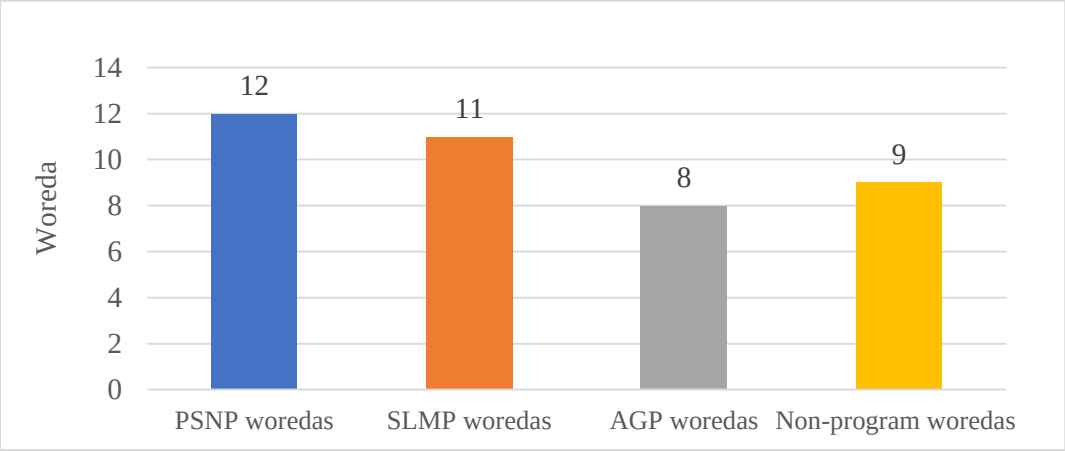
The Survey covered 40 Woredas drawn from five regional states (Amhara, Oromia, Somali, Gambela and the Southern Nations, Nationalities and Peoples' Region (SNNPR)) and one City administration (Dire Dawa). Thirty-one of these Woredas were from flagship programmes, while the remaining nine were from non-programme Woredas. We used systematic random sampling to draw 50 households from each Woreda (see Table 1.1).

Table 1.1: Distribution of Woredas and households, by region

Region	No. of Woredas	No. of Kebeles	No. of HHs
Amhara	11	33	550
Oromia	11	33	550
SNNP	13	39	650
Somali	2	6	100
Gambela	2	6	100
Dire Dawa City	1	3	50
Total	40	120	2,000

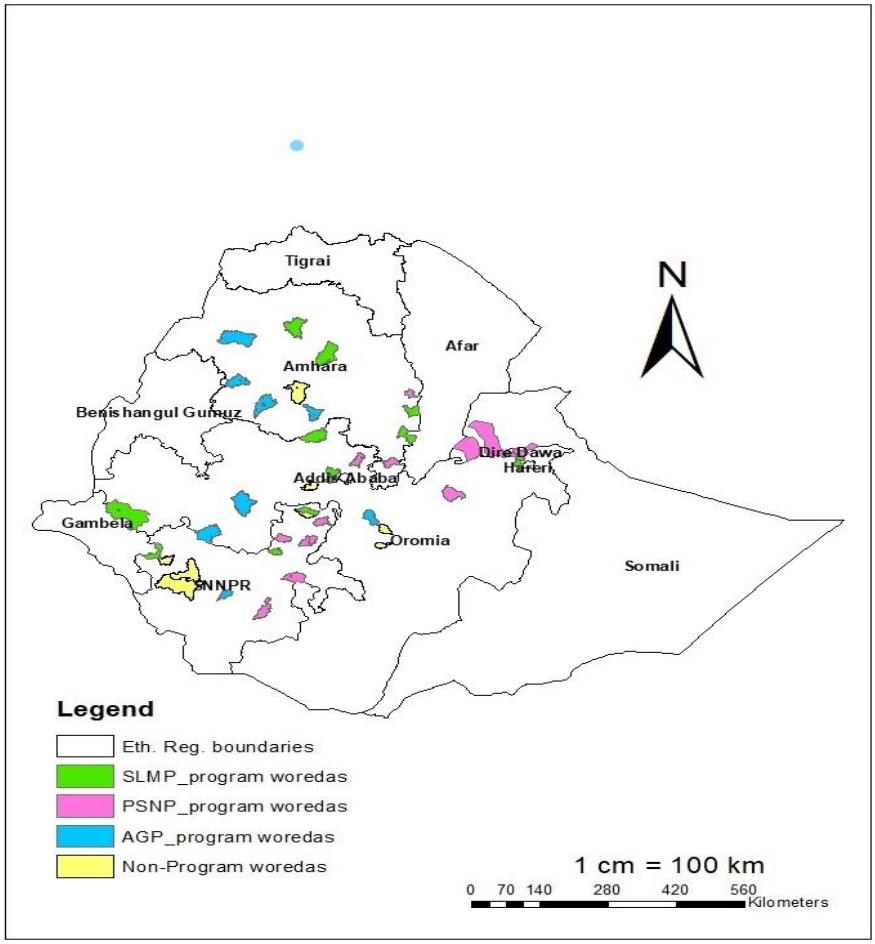
Source: Own computation based on RCC Survey 2021

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



Source: Own computation based on RCC Survey 2021

Figure 1.2: Map of Woredas included in the sample



Source: Own computation based on RCC Survey 2021

1.3.2 Sampling Frame

The sampling frame for the three flagship programmes (SLMP, PSNP, and AGP) accounted for 77 percent of the total sample of Woredas. The remaining nine out of 40 Woredas (23 percent) were non-programme Woredas not covered by any of these three flagship programmes. We obtained a list of beneficiary Woredas for the flagship programmes from their coordinating offices under the Ministry of Agriculture. Inaccessible Woredas and Woredas with a security problem were dropped before sampling. The number of Woredas specified in Table 1.1 were then randomly drawn from the respective list of Woredas.

1.3.3 Sampling Strategy and Selection Criteria

The sampling strategy used the representativeness of the population as a critical principle. Three stages of sampling were undertaken, namely: drawing sample Woredas, sample Kebeles, and sample households. Sample Woredas were drawn from the list of the beneficiary (programme) and non-beneficiary (non-programme) Woredas. Programme Woredas refer to those where PSNP, SLMP, and/or AGP were operational.

The survey team took the following steps to draw sample households from programme Woredas. First, they contacted the Woreda focal person for the respective programme. Second, they collected the list of beneficiary and non-beneficiary Kebeles within the Woreda. Third, they randomly selected two beneficiary and one non-beneficiary Kebeles from each sample Woreda. Fourth, they contacted the 'Kebele Committees' of the respective programme (i.e. PSNP Kebele Committee, Kebele Watershed Management Committee (for SLMP), Kebele AGP Coordinating Committee). Fifth, they obtained the list of beneficiary households for the first and second beneficiary Kebeles and randomly drew 18 households from the first beneficiary Kebele and 17 households from the second, making a total of 35 beneficiary households from each Woreda (70 percent of the sample households in the Woreda). This was done to ensure the inclusion of sample households from beneficiary households. Finally, the survey team obtained the list of non-beneficiary households from non-beneficiary Kebele (third Kebele selected from the Woreda) and randomly drew 15 households (30 percent of the sample households in the Woreda). When there was a need for replacement, a supervisor asked the principal investigator (PI) and survey coordinator for permission for this.

The selection of sample households from non-programme Woredas also followed the same procedure. Seventeen households were randomly drawn from each of the first and second Kebeles

selected and 16 households from the third Kebele, making a total of 50 sample households from the three Kebeles.

Before commencing the survey, all the supervisors consolidated a list of all Kebeles, all households, randomly selected Kebeles, and sampled households in either Excel or picture format and obtained the consent of the survey coordinator, data manager, and PI.

1.3.4 Survey Implementation: Survey Instruments, Training, Pre-test, and Fieldwork

SURVEY INSTRUMENT

Questionnaires are designed to collect quantitative or qualitative information from respondents (households). In our case, the team designed and administered a household survey questionnaire with five main themes: household roster; agricultural production and technologies, livestock, and non-farm activities; wealth and consumption; climate change perception, drought, and resilience capacities; and risk preference, time preference, and guessing-game experiments.

TRAINING AND PRE-TEST

Forty enumerators and 11 supervisors were trained for one week on using the paper-based questionnaire and CAPI (computer assisted personal interview). They conducted mock interviews at the end of each training session and they were sent to Adea Woreda to pre-test (pilot) the questionnaire at the end of their training. The team were then debriefed and changes were made to the questionnaire based on feedback from the fieldwork. The distribution of fieldworkers across regions is shown in Table 1.2.

Table 1.2: 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 2021

FIELDWORK

The fieldwork took about a month to administer 2,000 households from 40 Woredas. The survey team comprised 40 enumerators, 11 supervisors, a survey coordinator, a data manager, and a research coordinator. The survey coordinator worked closely with the supervisors and enumerators to check progress daily. A survey protocol was developed to guide sampling procedures and related fieldwork activities. The fieldwork was closely followed by the survey manager. The chain of communication was typically as follows:

Enumerators, assisted by supervisors, synchronized the data every two days to the server, which the programmer directly controlled. The programmer then exported the data to STATA and CSEntry files and shared it with the research and survey coordinators. The data was then cleaned, verified, and modified jointly by the programmer and survey and research coordinators.

Supervisors carried out spot checks during the interviews and later in the evenings to identify any errors by the enumerators. The survey coordinator monitored this process centrally by distributing a template for checking errors. The types of media created to ease communication between the supervisors in the field and coordinators at the centre, including the PI, were group telegram, group short message service (SMS), phone calls, and group email. Telegram was the most frequently used and the easiest/most convenient way to exchange ideas and documents.

1.4 Data Processing (Entry and Cleaning)

Data management entails developing effective processes for consistently collecting and recording data, storing data securely, cleaning data, transferring data (e.g. between different types of software used for analysis), effectively presenting data, and making data accessible for verification and use by others.

To get valid, reliable, and complete data timely, we used CSEntry to design the CAPI application for the survey. CSEntry is a CSPro software data collection tool that can run on both Windows and Android platforms. Using the CSEntry CAPI application involved creating an encrypted CAPI application and uploading it to the server (CSWeb, FTP, or Dropbox server). All

field staff members were able to install the CAPI application from the Cloud using their username and password but they could not change the application as it is encrypted software.

By installing the application, the field staff were able to synchronize their data to the server and update the application if there was a programme update. Before sending their data to the server, their supervisors checked it using a Bluetooth connection. After getting confirmation from a supervisor, they synchronized their data to the server. Also, using CSPro, the data file, and encrypted CAPI application enabled the data size to be made very small or manageable to download or transfer, making it easy for them to synchronize their data using mobile data on their tablets.

The programmer (data manager) downloaded the synchronized data from the field staff, conducted various checks to import data, removed incomplete cases, and removed oversampled and unwanted observations. As one of the main goals of data cleaning is to ensure that the dataset is free of unwanted observations, this represented the first step in data cleaning.

KEY INFORMANT (KI) INTERVIEW

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 particular 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 have good knowledge of development interventions in their community or Kebele. The checklist which we used comprised significant components of the quantitative survey, and consultative meetings were held with the above four categories of KIs. Field-level project sites were visited to capture the effectiveness of investment and community benefits.

1.5 Challenges Faced by the Team

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

- Reaching out to the respondents was not easy as the random selection technique meant that sample households were widely dispersed. Limited means of transportation also meant that the field staff had to spend up to four hours travelling from one household to another.

- Selected households were sometimes not found in the village because of migration or death, or for other reasons.
- There was a lack of organized household lists for sampling in some of the Kebeles, particularly in the Somali region.

The report proceeds as follows. Chapter 1 gave a general introduction to the project and the survey and the following five chapters discuss the different questionnaire modules in detail. While Chapter 2 focuses on household characteristics, Chapter 3 analyses questions related to agricultural production and technologies, livestock, and non-farm activities. This is followed by discussions about wealth and consumption in Chapter 4 and issues related to drought exposure and resilience capacity in Chapter 5. Chapter 6 discusses hypothetical games and Chapter 7 summarizes the findings.

CHAPTER 2: HOUSEHOLD CHARACTERISTICS: DEMOGRAPHY, EDUCATION, AND OCCUPATION

HIGHLIGHTS:

- The average household size was 5.5 individuals, with an almost equal distribution of males and females; however, only 18 percent of the households interviewed were headed by females.

- The households in the sample were primarily engaged in agriculture, and almost half of household heads were illiterate.

2.1 Household and Household Head Characteristics

Based on the 2,000 households interviewed, Table 2.1 provides summary statistics on key demographics and household head characteristics.

The average number of household members among those interviewed was 5.5, with an almost equal distribution of males and females. The average number of children aged under 5 years was 0.7, ranging between 0 and 5, and the average number of household members aged over 59 was 0.2, ranging between 0 and 3.

The average age of household heads was 46 years, with a range between 20 and 95 years. Only 18 percent of the households interviewed were headed by a female, and 83 percent of household heads were married. Ninety-five percent of the sampled household heads named agriculture as their occupation.

Looking at education levels, almost half the household heads in the sample were illiterate, while 31 percent had completed some or all of primary school education, and 13 percent had some secondary education. Among household members in general, around 30 percent were illiterate, 46 percent had primary education, and 23 percent had attended secondary school or above. Figures 2.1 and 2.2 show the distribution of all education levels by gender for household heads and members, respectively.

Figures 2.3 and 2.4 show the average number of children and elderly household members, by region. In the Dire Dawa and Somali regions, the sampled households generally had more

young children and fewer elderly than the other regions. Amhara and Oromia were the regions where most households contained elderly members.

Table 2.1: Household characteristics

	Mean	SD	Min	Max
HH size and composition				
Household size	5.5	2.2	1.0	16.0
No. of children < 5	0.7	0.8	0	5
No. of elderly 60 +	0.2	0.5	0	3
HH characteristics				
Age	45.9	13.3	20.0	95.0
Female	0.2	0.4	0.0	1.0
Married	0.8	0.4	0.0	1.0
Widowed	0.1	0.3	0.0	1.0
HH education and occupation				
Illiterate	0.5	0.5	0.0	1.0
Some primary	0.2	0.4	0.0	1.0
Primary completed	0.1	0.3	0.0	1.0
Some secondary	0.1	0.3	0.0	1.0
Beyond secondary	0.0	0.2	0.0	1.0
Adult literacy programme	0.0	0.2	0.0	1.0
Religious	0.0	0.1	0.0	1.0
Occupation: agriculture	1.0	0.2	0.0	1.0
Observations	2,000			

Source: Own computation based on RCC Survey 2021

Figure 2.1: HH education, by gender

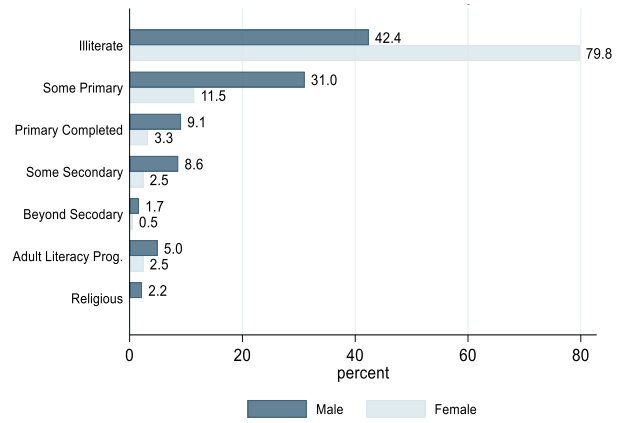
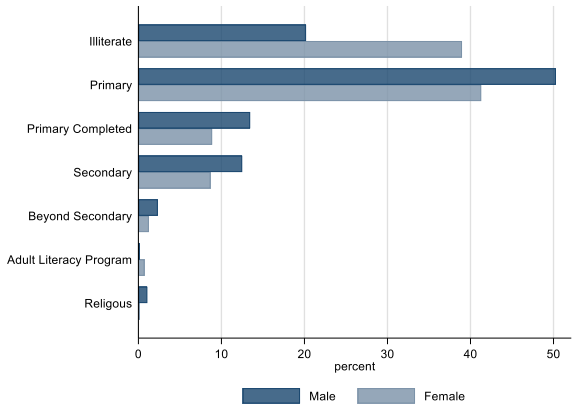


Figure 2.2: Education of HH members, by gender



Source: Own computation based on RCC Survey 2021

Figure 2.3: Average no. of children aged under 5

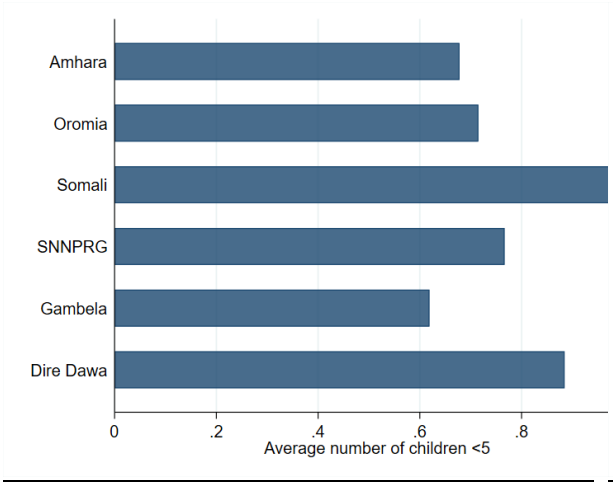
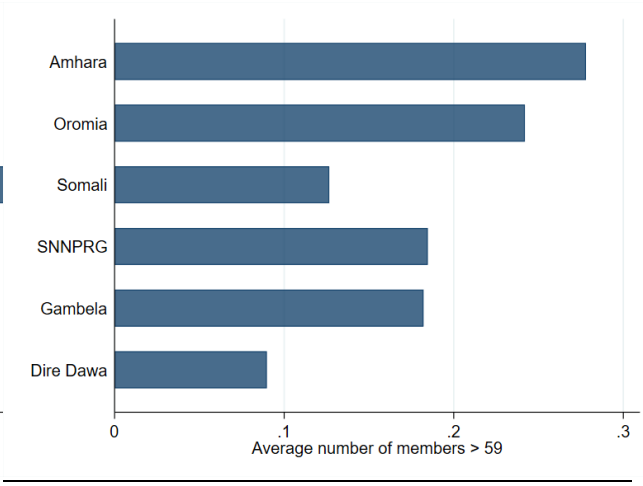


Figure 2.4: Average no. of HH members aged over 59



Source: Own computation based on RCC Survey 2021

The education levels were split by region (Figures 2.5. and 2.6), revealing a substantial difference across the study areas. Dire Dawa had the largest share of illiterate household heads and Gambela had the lowest share. When looking at household members in general, our sample in Gambela seems to contain better-educated members, while the levels were generally low in the Somali study area.

Figure 2.5: HH education, by region

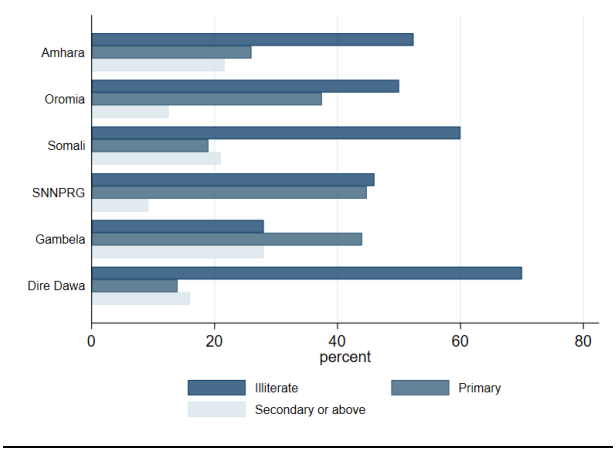
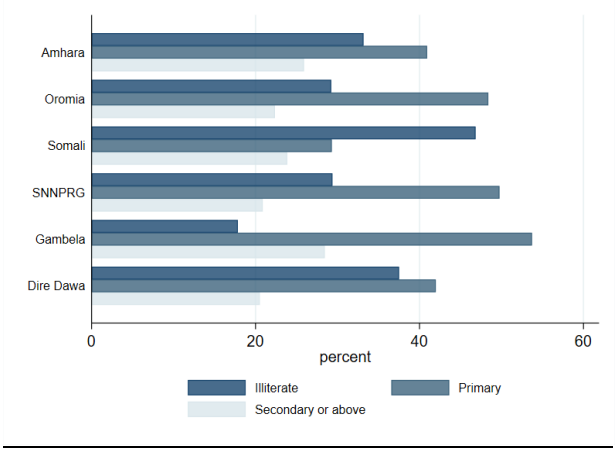


Figure 2.6: Education of HH members, by region



Source: Own computation based on RCC Survey 2021

CHAPTER 3: AGRICULTURAL PRODUCTION AND TECHNOLOGIES, LIVESTOCK, AND NON-FARM ACTIVITIES

HIGHLIGHTS:

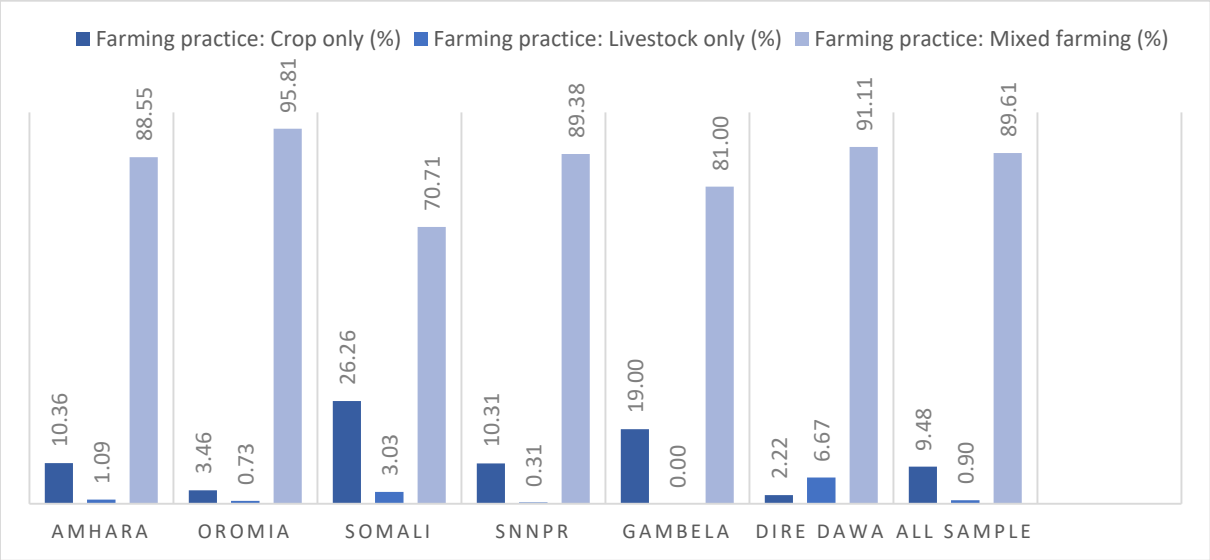
- Most households were engaged in mixed farming (both crops and livestock), with each household having an average of three parcels of land.
- The use of extension services, irrigation, and improved seeds was relatively rare for both harvest seasons.
- Most of the respondents produced cereals, but cereals were a less commercialized crop and a large share of the production was consumed.
- Employment outside agriculture was rare, with only 28 percent of households participating in non-farm activities.

3.1 Land-holding and Certification

Most of the sampled households (about 90 percent) were engaged in a mixed farming system[1] where crops and livestock production were integrated. However, about 10 percent and 1 percent of households were engaged in crop and livestock farming systems, respectively. Therefore, mixed agriculture was the dominant agricultural system in most of the regions studied, apart from the Somali region where 71 percent, 26 percent, 5 percent, and 3 percent of households practised mixed farming, crop-only, agro-pastoral, and livestock-only farming systems, respectively. Figure 3.1 summarizes the three central farming systems practised at the national and regional levels.

[1] A farming system is defined here as a group of individual farm configurations that broadly contain a similar resource base, enterprise patterns, household livelihoods, and constraints; hence similar development strategies and interventions would be appropriate to enhance their growth potential (Dixon et al., 2001).

Figure 3.1: Summary of main farming systems, by region



Source: Own computation based on RCC Survey 2021

Regarding the land-holding rights of farm households, almost all (about 94 percent) stated that they had land-holding rights. Our comparison across sampled regions shows similar results, although a relatively smaller proportion of households (61 percent) in the Somali region reported having land-holding rights. The average farm size of the households' holdings was 1.12 ha, similar to the national land-holding average of 1.06 ha per household in 2015/16. However, the data on average farm-holdings showed a wide variation across the six regions sampled, with significant differences between regions (Table 3.1). The average farm land-holding per household in Oromia, Somali, and Gambela were, respectively, 1.7, 1.6, and 1.3 ha, indicating that farmers in these regions had larger land-holdings than farmers in the other regions. However, the average land-holdings in Dire Dawa, Amhara, and SNNPR were 0.4 ha, 0.7 ha, and 0.9 ha, respectively, which is below the national average.

Furthermore, most farm households (81 percent) reported that they had not experienced a change in the size of their land-holding in the last five years (since Meskerem 2007). A similar proportion (79 percent) of farm households did not expect a change in the size of their land-holdings in the next five years. However, we observed significant variations across the sampled regions in response to both scenarios. For example, approximately 90 percent of farmers in the Somali region reported that they had not experienced a change in the size of their land-holdings

during the last five years. About 14 percent of farmers in Oromia expected to increase the size of their land-holding.

Table 3.1: Summary of land-holding history, by region

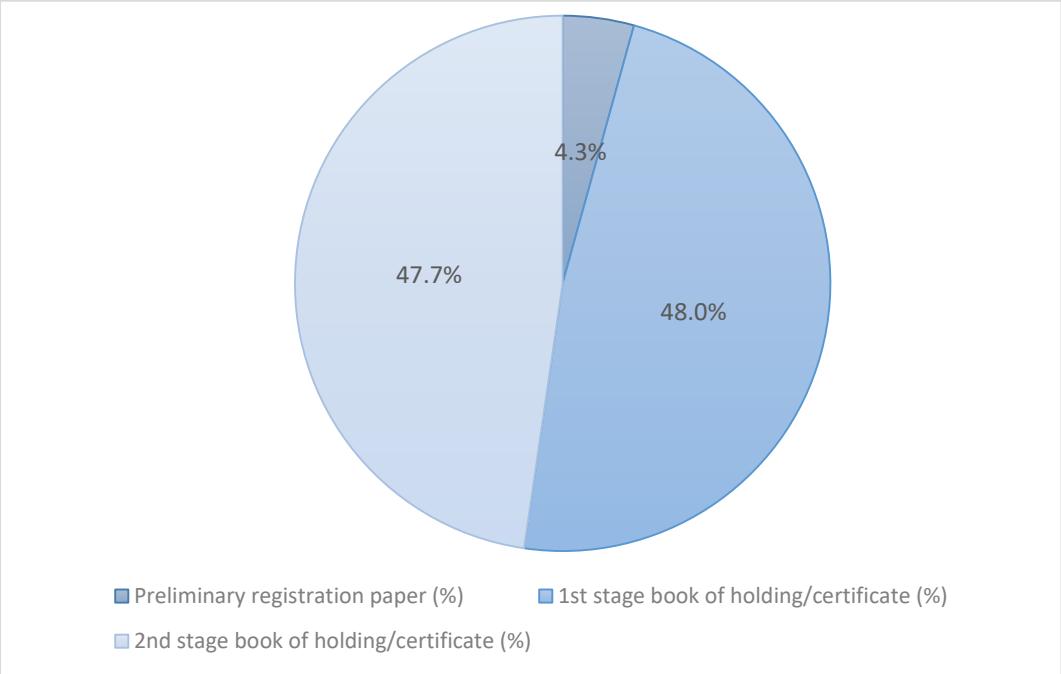
Land-holding characteristics	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Full sample
Has land-holding right (%)	94.0	97.8	61.0	92.9	100.0	84.0	93.1
Area of land-holding (ha)	0.7	1.7	1.6	0.9	1.3	0.4	1.1
Land-holding change experience (%)	17.3	28.2	1.0	12.3	48.0	6.0	19.1
Expect increase in land-holding (%)	9.6	14.4	8.1	6.9	5.0	0.0	9.6
Expect decrease in land-holding (%)	13.6	10.8	2.0	7.9	32.0	9.5	11.2
Expect no change in land-holding (%)	76.7	74.9	89.9	85.2	63.0	90.5	79.3
Land certificate for all holdings (%)	76.2	66.7	10.1	71.5	71.0	23.8	67.4
Land certificate for some holdings (%)	7.1	18.6	0.0	14.9	5.0	0.0	12.2
No land certificate for all holdings (%)	16.7	14.8	89.9	13.5	24.0	76.2	20.4

Source: Own computation based on RCC Survey 2021

It has been widely reported that Ethiopia has one of the world's most cost-effective systems for documenting land-holdings – the land certification system – to improve tenure security and address the problems which stemmed from a lack of it. In addition to the land certification system that emerged in the late 1990s and early 2000s, which took the form of a paper-based land-use certificate, a second phase, using geographic information system technology, is now being implemented. In this survey, we looked at the certification of farmers' land-holdings. The data indicated that only about 67 percent of the farmers had certificates for all their holdings, while 20 percent had no certificates. We observed significant variations across the different regions: for example, about 76 percent of farmers in the Amhara region had certificates for all their holdings.

Among those with certificates for all or some of their land-holdings, we found that 48 percent, 48 percent, and 4 percent of the farm households, respectively, had second stage with cadastral map, first stage certificates, and preliminary registration papers (Figure 3.2). About 71 percent, 43 percent, and 39 percent of the farmers in Amhara, SNNPR, and Oromia had second stage certificates for their land-holdings. In comparison, 84 percent and 80 percent, respectively, of farmers in the Gambela and Dire Dawa regions had first stage certificates. Figure 3.2 summarizes the types of land certification documents held by the farm households in our sample.

Figure 3.2: Land certification types

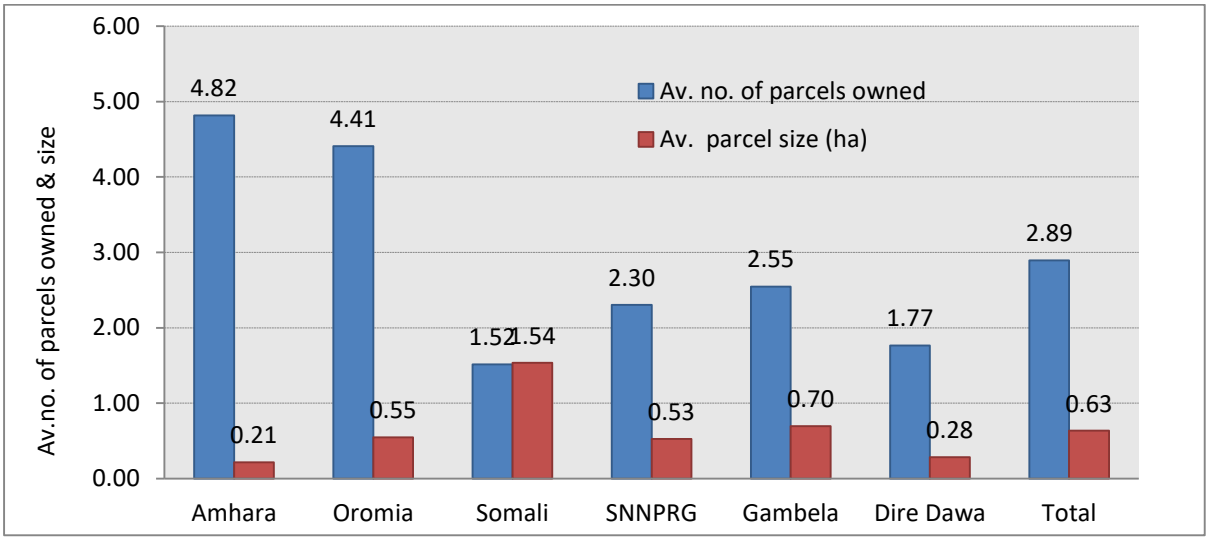


Source: Own computation based on RCC Survey 2021

LAND PARCEL CHARACTERISTICS

On average, a typical farm household held about three parcels of land and a farm household's typical parcel of land measured 0.6 ha, on average. Our observations across the six regions showed significant variation in both of these land parcel features (Figure 3.3). Regarding the average number of parcels, a typical farm household in Amhara and Oromia held about 4.8 and 4.4 parcels, respectively, while the typical farm household in Somali and Dire Dawa held only 1.5 and 1.8 parcels, respectively. In terms of parcel size, while the average parcel size was as large as 1.5 ha in the case of Somali, it was as small as about 0.2 ha and 0.3 ha in Amhara and Dire Dawa, respectively.

Figure 3.3: Average parcel size in hectares and average number of parcels per household



Source: Own computation based on RCC Survey 2021

Ethiopia's current constitution states that '*the rights to ownership of land (rural and urban) and all natural resources are exclusively vested in the State and the peoples of Ethiopia*'. The constitution ensures free access to agricultural land. Individuals can acquire land in a variety of ways in Ethiopia. The law recognizes the following ways for individuals to get rural land: land granted by the government through its land administration apparatus, inheriting or being given land by a family member, and other means by which land-use rights can be transferred temporarily such as renting and leasing. Against this background, we looked at the land acquisition method, percentage of land owned, and land managed by the different family members.

With regard to land acquisition sources, most of the farm households sampled (about 60 percent) had inherited their land-holdings, while 30 percent had secured their land-holdings from their local (Kebele) administration office. Relatively insignificant proportions, about 4 percent and 3 percent of the farmers, respectively, had obtained their land-use rights via crop-sharing and renting. Inheritance of land featured more prominently among farmers in Somali, SNNPR, and Oromia (90 percent, 75 percent, and 42 percent, respectively). Conversely, a small proportion of the farmers in Somali and Dire Dawa (only 5 percent and 10 percent, respectively) had acquired their land from the local administration office. In contrast, a significant proportion of farmers in Gambela, Oromia, and Amhara (64 percent, 43 percent, and 39 percent, respectively) had obtained their land from this source.

In relation to the rights held by the different members of farm households, we found that about 66 percent of the land was jointly owned by men and women (Table 3.2). We observed a different pattern for the land management decision-making powers of the different members of a given farm household. On average, 98.7 percent of land management decisions were made by the household head. In all regions, it was the household head who had the decision-making power for management of the land.

Regarding soil type, soil quality, and the slope characteristics of land parcels, by and large the soil types were dark or red soil (for 46 percent and 35 percent of the households, respectively). The majority of the households (86 percent) considered their land parcels to be either good (*lem*) or fair (*lem-tef*), and most also reported having either flat plots (44 percent) or land with medium sloped plots (43 percent). Significant heterogeneity in soil type, quality, and plot slope was observed across the regions (Table 3.2). For example, only 8 percent of farm households in Dire Dawa rated their soil quality as good, while 46 percent of farm households in the Amhara region rated their soil quality as good.

Finally, it is worth mentioning that, on average, a typical parcel of land was a 17.2-minute walk from the homestead and a 24-minute walk, at least, from the homestead for farm households in the Dire Dawa and Somali regions. It was at most about an 11.5-minute walk away from the homestead for the households in Gambela and SNNPR.

Table 3.2: Parcel characteristics

Parcel characteristics		Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Total
Land acquisition method (%)	From Kebele	39	43	5	12	64	10	30
	Inherited	34	42	90	75	29	0.9	60
	Rented	8	6	2	3	1	0	3
	Shared crop	13	7	1	3	2	0	4
	Other ways	7	2	3	8	4	0	3
Land owned by (%)	HH head	21	16	77	32	17	16	23
	Spouse	59	78	19	65	81	73	66
	Other individual	20	6	4	3	2	11	11
Decision made by (%)	HH head	99.5	97.1	100	100	100	100	98.7
	Spouse	0.5	2.9	0	0	0	0	1.3
	Other individual	0	0	0	0	0	0	0
Soil type (%)	Dark soil	42	58	76	43	48	11	46
	Red soil	40	37	21	54	41	18	35
	Other soil type	17	5	2	02	11	60	17
Soil quality (%)	Good (*Lem*)	46	37	38	31	35	8	32
	Fair (*Lem-Tef*)	40	56	53	57	60	60	54
	Poor (*Tef*)	14	8	09	12	5	32	13
Slope of plot (%)	Flat	59	45	63	38	44	15	44
	Medium	31	46	30	44	52	54	43
	Steep	9	9	7	18	4	31	13
Distance from homestead (minutes)		18.5	13.1	24.1	11.5	11.3	24.6	17.2

Source: Own computation based on RCC Survey 2021

PLOT-LEVEL LAND MANAGEMENT AND ADOPTION OF AGRICULTURAL TECHNOLOGY

The plot-level descriptive analysis of land management and adoption of agricultural technology was conducted based on Ethiopia's two rainy seasons. According to CSA (2016), the main rainy season is the Meher, which covers the period between Meskerem (September) and Yikatit (February). The other rainy season, the Belg season, runs between Megabit (March) and Nehase (August). It is also worth noting that: (1) the agricultural seasons under consideration in this study are for the year 2019/2020 (2012 EC); and (2) all six regions sampled except Dire Dawa have harvests during both the Meher and Belg seasons. As an essentially arid area, Dire Dawa only has the Meher season harvests.

The average plot area cultivated during the two harvest seasons shows that farmers cultivated relatively more land during the Meher season (1.2 ha) compared to the Belg season (1.1 ha) (Table 3.3). Across regions, households in the Somali (2 ha) and Oromia (1.8 ha) regions cultivated relatively more land during the Meher season but relatively less land in the Amhara region (0.7 ha). With regard to the type of seeds used, farm households in all six regions relied heavily on traditional seeds. We also observed that farmers in all regions used less second- and third-generation seeds (C2 and C3) than other seeds. For example, the average amounts of traditional seeds, improved seeds, and C2 and C3 seeds used per plot by farmers during the Meher season in Oromia were, respectively, 84.7 kg, 27.7kg, and 8.8 kg per hectare, while the average amounts used by farmers in Amhara were 79.7 kg, 12.4 kg, and 4.5 kg respectively. Our observations across regions show that farmers in Oromia and Amhara used more seeds (of all three types) per hectare than farmers in the SNNPR, Somali, and Gambela.

In terms of fertilizer applications, larger average amounts of different types of fertilizers were used per plot during the Meher season than the Belg season in all regions sampled. We also observed that farm households predominantly relied on using mixed Urea and Di-ammonium Phosphate (DAP), while blended fertilizer was used in smaller quantities per plot. As for seeds, on average, farmers in the Oromia and Amhara regions used more of all three types of fertilizers per plot in both harvest seasons than their fellow farmers in the other regions. Farmers in Gambela did not apply any of the three fertilizer types (during the two harvest periods). Furthermore, farmers in all regions applied manure and compost during the two harvest seasons, though at varying scales. However, greater amounts of manure were applied, on average, per plot than compost in both harvest seasons across the six regions. For example, during the Meher season alone, farmers in Amhara, Oromia, and the SNNPR applied, on average, 623.8 kg, 247.5 kg, and 353.1 kg of manure per hectare, respectively, while those same farmers applied, on average, 190.3 kg, 42.6 kg, and 17.5 kg of compost per plot, respectively.

Overall, the use of extension services, irrigation, and improved seeds was relatively rare during both harvest seasons (Figure 3.4). However, there were a few exceptions. For example, 52 percent of households in the Amhara region had access to extension services during the Meher season, while 59 percent of their fellow farmers in the Somali region had access to irrigation during the same season. These three practices further declined during the Belg season in all regions.

The average number of tillages per plot that farmers applied varied significantly across regions but remained similar between seasons in each region. Farmers in the Amhara and Oromia regions had, on average, the highest number of tillages per plot (about 3.3 each during Meher and 3.0 and 3.7 during Belg, respectively), while farmers in Gambela had, on average, the lowest number of tillages (1.8 during Meher and 1.5 during Belg) (Figure 3.5).

Although legume planting helps to improve soil's organic matter, porosity, structure, and PH levels, few farmers in the regions in our sample had produced legume crops in the previous three years. During the primary harvest season, Meher, 25 percent and 18 percent of farmers in the Amhara and Oromia regions, respectively, had planted legume crops in the previous three years (Figure 3.6). During the Belg season, the share of farmers in the SNNPR (21 percent) and Somali (17 percent) who had planted legumes had increased in the previous three years, while that of farmers in the other regions had decreased.

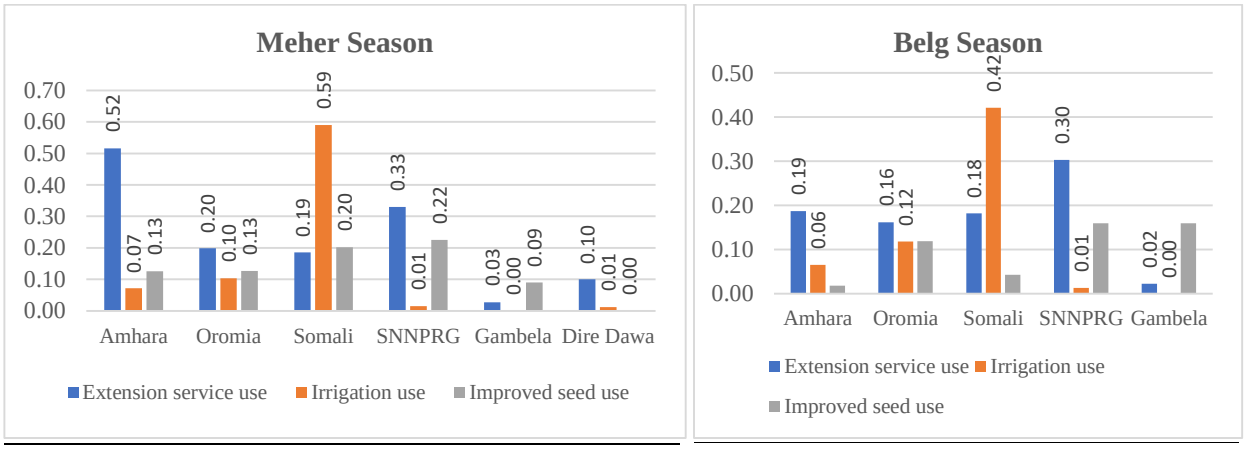
The practice of agricultural water management was almost non-existent among farm households in all but the Somali region; 61 percent and 55 percent practised water management during the Meher and Belg seasons, respectively. Figure 3.6 shows farm household legume-planting and agricultural water-management practices during the Meher and Belg seasons.

Table 3.3: Plot-level characteristics

	Meher season						Belg season				
Plot characteristics	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Amhara	Oromia	Somali	SNNPR	Gambela
Area cultivated (ha)	0.7	1.8	2.0	1.0	1.4	0.4	0.9	1.2	1.6	0.7	1.3
Improved seeds (kg/ha)	8.8	49.4	1.5	7.6	1.0	0.0	13.0	240.4	0.2	13.0	3.5
C2 or C3 seeds (kg/ha)	3.2	15.8	0.3	2.0	0.0	0.0	0.0	0.0	4.6	3.3	0.0
Traditional seeds (kg/ha)	56.4	150.8	16.3	21.5	11.1	17.2	117.0	235.5	35.3	41.6	4.9
Fertilizer: Urea & DAP (kg/ha)	138.0	136.1	36.4	33.3	0.2	9.1	36.9	132.2	21.5	16.7	0.0
Fertilizer: Urea (kg/ha)	104.2	55.5	40.3	25.4	0.1	316.6	14.5	18.7	21.8	11.7	0.0
Fertilizer: Blended fertilizer (kg/ha)	1.2	9.1	1.8	0.4	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Manure (kg/ha)	441.3	410.7	23.3	277.1	8.0	500.2	245.9	300.0	25.0	239.2	7.1
Compost (kg/ha)	190.30	88.41	9.12	11.96	0.36	12.72	418.71	42.62	4.59	17.54	0.0

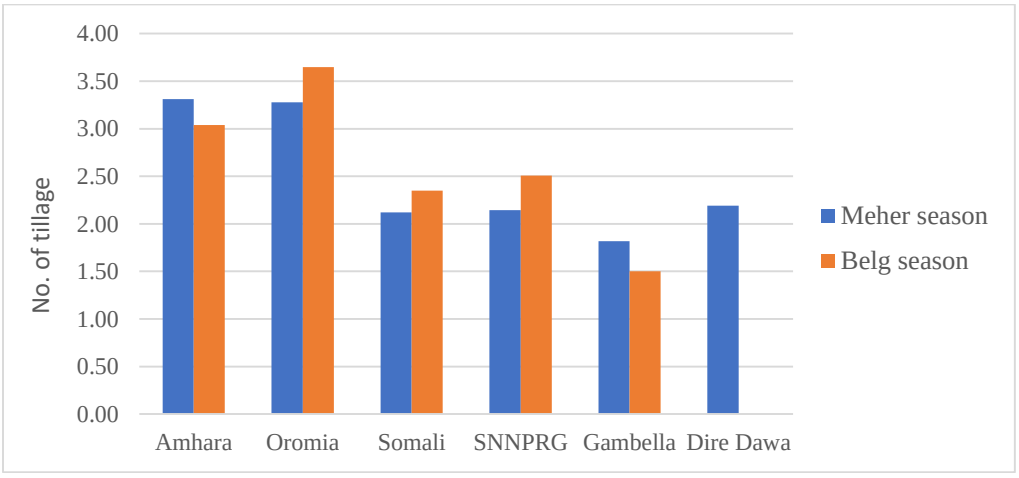
Source: Own computation based on RCC Survey 2021

Figure 3.4: Household use of extension service, irrigation, and improved seeds (percent)



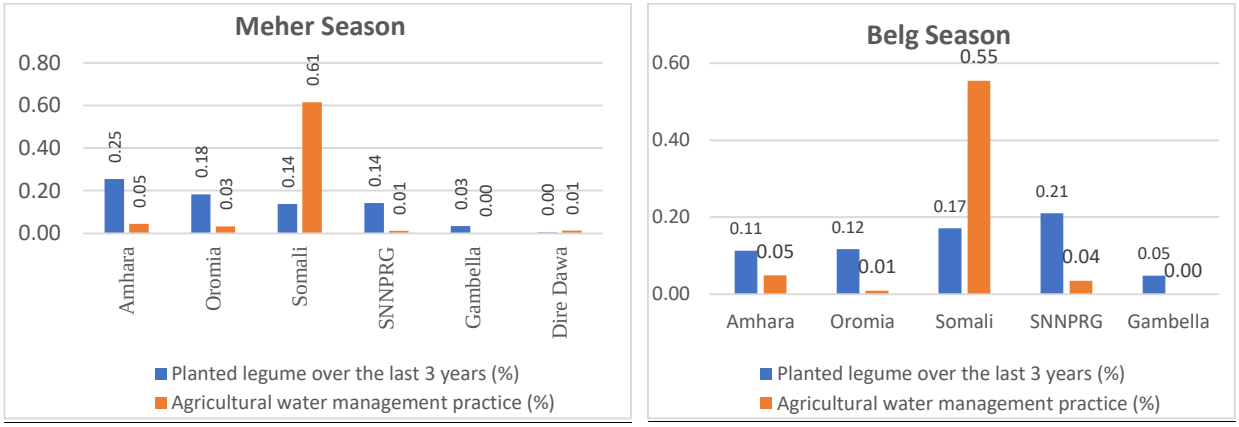
Source: Own computation based on RCC Survey 2021

Figure 3.5: Average number of tillage per plot



Source: Own computation based on RCC Survey 2021

Figure 3.6: Involvement in legume planting and agricultural water-management practices (percent)



Source: Own computation based on RCC Survey 2021

Plot preparation methods varied significantly across regions, although they were more or less the same in both the Meher and Belg seasons (Table 3.4). For example, during the Meher season alone, digging by hand was mainly practised by farm households in Somali (58 percent), SNNPR (66 percent), Gambela (98 percent), and Dire Dawa (91 percent), while the majority of farmers in Amhara (89 percent) and Oromia (71 percent) mainly used oxen to prepare their plots. Tractors were almost never used by farmers to prepare land in both seasons, although 26 percent and 46 percent of farmers in Somali used them during the Meher and Belg seasons, respectively.

Furthermore, farm households engaged in multiple soil-erosion prevention activities on their plots in varying proportions across the regions and during the harvest seasons. Among these activities, a relatively significant proportion of farmers practised terracing and contour ploughing in all six regions. However, afforestation, planting grass, and banning grazing on plots were practised by a smaller proportion of farmers in all regions except Somali (where banning livestock grazing was practised by a significant proportion of farmers – 44 percent during Belg and 31 percent during Meher) and Gambela (where a significant proportion of farmers, 17 percent and 15 percent, respectively, practised grass planting and afforestation during the Belg season). More detailed observation of soil-erosion prevention activities shows that very significant proportions (at 86 percent, 63 percent, and 50 percent of farmers in Dire Dawa, Somali, and Oromia, respectively) engaged in terracing during the Meher season, while 52 percent and 41 percent of farmers in Amhara and Somali, respectively, did the same during the Belg season. Similarly, water catchment exercises were more common among farmers in Amhara, where 40 percent and 38 percent did these exercises during the Belg and Meher seasons, respectively. Half of farmers in both Amhara and Oromia practised contour ploughing during the Meher season, while 61 percent, 56 percent, and 51 percent, respectively, of farmers in Amhara, Oromia, and Somali did the same during the Belg season.

Farmers in the six regions sampled also engaged in multiple activities to improve their plot's soil fertility (during both harvest seasons). Among these activities, a relatively large proportion of farmers in almost all regions practised crop rotation, made moderate use of chemical fertilizers, and used natural fertilizers (during both harvest seasons). An insignificant share of farmers engaged in planting different crops in a field, covering the field plot surface with crop residue/leaves, and planting temporary crops in a row with permanent crops in all regions except Somali (where a significant share of farmers engaged in almost all these activities) and Gambela

(where a large share of farmers (44 percent) exceptionally engaged in the planting of temporary crops in a row with permanent crops).

Finally, with regard to the use of chemicals against crop diseases, with few exceptions, herbicides, pesticides, and fungicides were used by an insignificant proportion of farmers (less than 10 percent in all cases) during both harvest periods. Of these exceptions, 37 percent, 26 percent, and 21 percent of farmers in Oromia applied herbicides, fungicides, and pesticides, respectively, during the Meher season, while 22 percent of farmers in the SNNPR applied herbicides during the Belg season.

Table 3.4: Plot-level activities

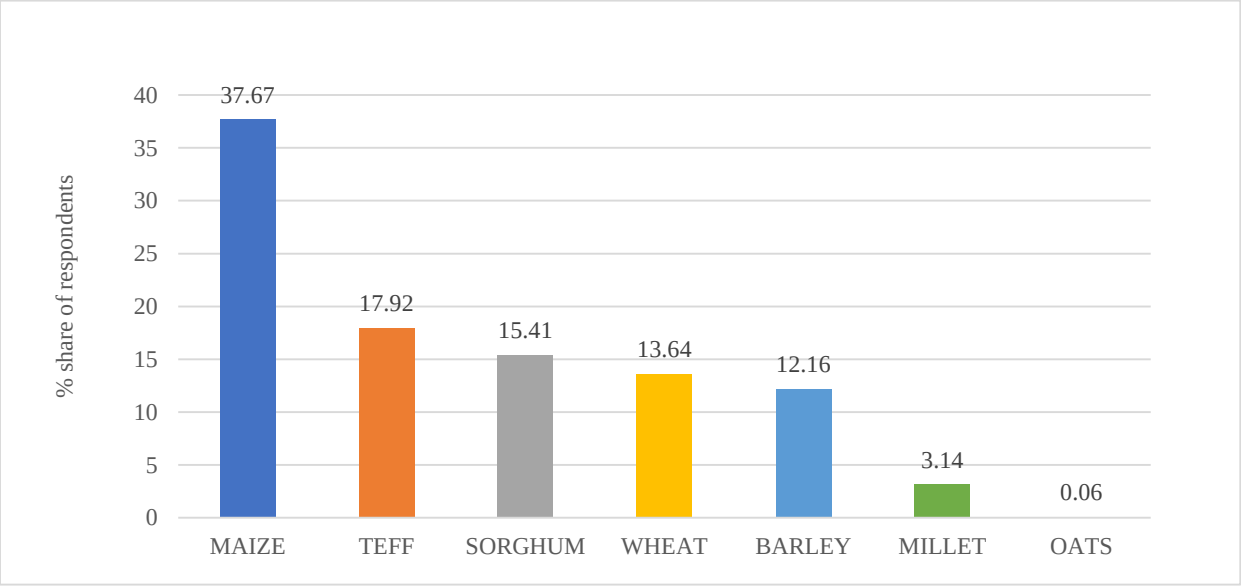
Plot characteristics	Meher season						Belg season				
	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Amhara	Oromia	Somali	SNNPR	Gambela
Plot preparation method:											
• Digging by hand	0.1	0.3	0.6	0.7	1.0	0.9	0.1	0.1	0.5	0.8	1.0
• Using livestock	0.9	0.7	0.6	0.3	0.0	0.1	0.9	0.9	0.0	0.2	0.0
• Using tractor	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Erosion prevention method:											
• Terracing	0.4	0.5	0.6	0.3	0.4	0.9	0.5	0.2	0.4	0.3	0.3
• Water catchments	0.4	0.1	0.3	0.0	0.3	0.2	0.4	0.1	0.3	0.0	0.1
• Afforestation	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
• Contour ploughing	0.5	0.5	0.3	0.2	0.2	0.2	0.6	0.6	0.5	0.1	0.2
• Planting grass	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
• Not allowing livestock to be on the plot	0.1	0.1	0.3	0.1	0.0	0.0	0.1	0.0	0.4	0.2	0.0
• Other method	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.2	0.0
Soil fertility-improving method:											
• Planting temporary crops in row with permanent crops	0.0	0.2	0.1	0.0	0.1	0.1	0.0	0.0	0.3	0.1	0.4
• Covering plot surface with crop residue	0.0	0.1	0.3	0.1	0.0	0.1	0.0	0.0	0.6	0.1	0.0
• Using natural fertilizer	0.3	0.3	0.3	0.5	0.1	0.8	0.4	0.3	0.2	0.5	0.0
• Moderate use of chemical fertilizer	0.6	0.4	0.7	0.5	0.0	0.2	0.6	0.8	0.4	0.4	0.0
• Banning grazing on crop field	0.0	0.1	0.3	0.0	0.1	0.0	0.0	0.1	0.4	0.1	0.2
• Planting different crops on field	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.3	0.1	0.0
• Crop rotation	0.7	0.6	0.2	0.3	0.7	0.4	0.7	0.5	0.6	0.2	0.4
Agrochemicals use:											
• Herbicide use	0.1	0.4	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.2	0.0
• Pesticide use	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.2	0.1	0.0	0.0
• Fungicide use	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0

Source: Own computation based on RCC Survey 2021

3.2 Crop Disposition/Commercialization

Production, consumption, and sales of cereals account for a significant share of total crop production in Ethiopia. Out of 1,752 households which reported producing one or more cereals, maize, teff, sorghum, wheat, and barley accounted for 37.7, 18, 15.4, 13.4 and 12.2 percent, respectively, of cereals produced (see Figure 3.7). Maize is usually considered a good security crop, which explains why it covers one-third of the total cereal area at the national level. Teff, the second most reported crop, is also a significant national food security and cash crop.

Figure 3.7: Respondents' production of different cereals (percent)



Source: Own computation based on RCC Survey 2021

When comparing respondents who expressed their engagement in the production of crops by crop category (i.e. cereals, pulses, oilseeds, vegetables, fruits, root crops, cash crops, and spices), the majority of the respondents reported producing cereals, showing the importance of cereal production for rural households' food security, cash income generation, and capacity to cope, etc. (see Table 3.5).

Table 3.5: Percentage of households growing different categories of crops

Crop category	%
Cereals	87.6
Pulses	25.6
Oilseeds	2.85
Vegetables	11.4
Fruits	22.25
Root crops	21.5
Cash crops	27.95
Spices	1.8

Source: Own computation based on RCC Survey 2021

Table 3.6 shows the average share of consumption out of total production. On average, households' own consumption was 41 percent of the total production but varied by crop type. Cereals were the most consumed crop type (52.4 percent), followed by pulses (10.7 percent), and fruits (10.6 percent). Cash crops were consumed by 11.4 percent, indicating that the lion's share is mainly produced for commercial purposes.

Table 3.6: Consumption share (percent), by crop category

Crop category	%
Cereals	52.4
Pulses	10.7
Oilseeds	1.0
Vegetables	4.3
Root crops	8.7
Spices	0.6
Cash crops	11.4
Fruits	10.6
Others	0.2

Source: Own computation based on RCC Survey 2021

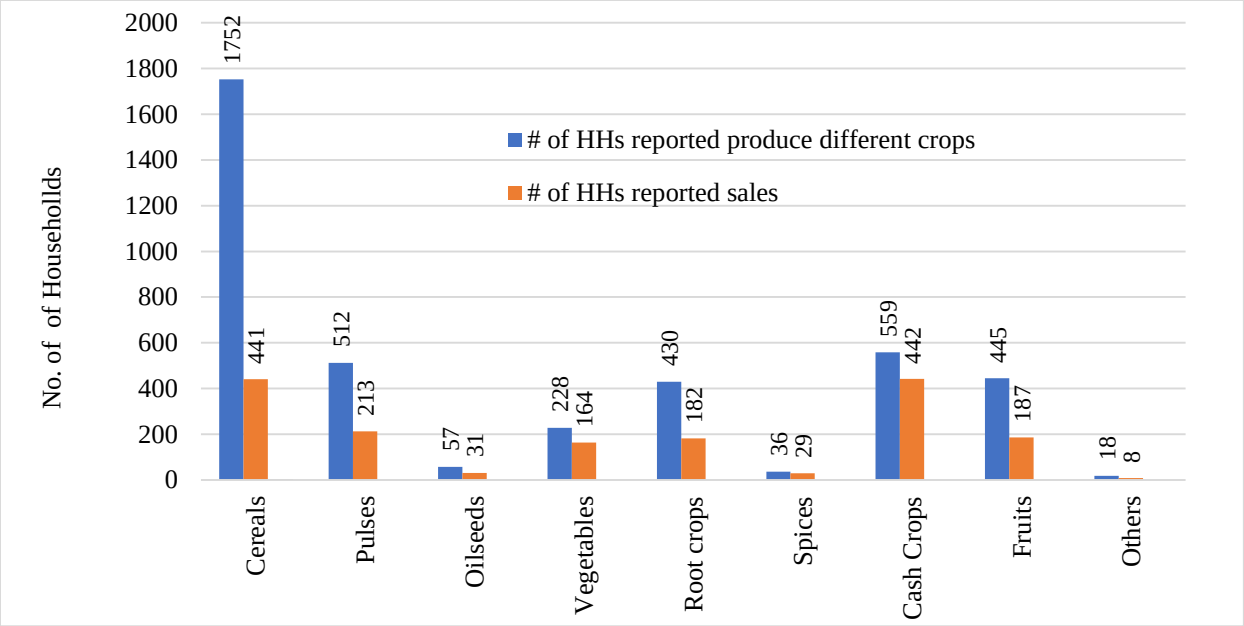
In terms of the average sales value by crop category, root crops, vegetables, cash crops, and fruits generated the highest values for households. However, cereals and pulses had the highest values in aggregate sales. The number of households which reported their sales compared to reporting their production was very small (Figure 3.8).

Table 3.7: Value of sales by crop category in Ethiopian birr (ETB)

Crop category	Obs.	Mean	SD
Cereals	441	7,764	3.1
Pulses	213	5,169	1.2
Oilseeds	31	7,255	1.4
Vegetables	164	16,234	1.6
Root crops	182	20,389	2.6
Spices	29	10,492	1.7
Cash crops	442	12,099	1.6
Fruits	187	11,156	2.9
Others	8	2,225	0.8

Source: Own computation based on RCC Survey 2021

Figure 3.8: Production and sales, by crop category



Source: Own computation based on RCC Survey 2021

CROP PRODUCTION AND HARVEST-RELATED CHARACTERISTICS

The farm households in our sample produced a variety of crops, including cereals, pulses, oilseeds, vegetables, root crops, spices, cash crops, and fruits during 2020. Here, we discuss the summary statistics on the average amounts of each crop type (per plot and hectare) harvested by the farm households in each region sampled.

Starting with cereals, farm households in each region cultivated 1.5 ha, while the corresponding production per plot was 12.8 quintal (qt) and yield/hectare was 19.9 qt. There were significant variations among farm households in different regions with regard to land size cultivated and its yield. While farmers in Dire Dawa and Amhara cultivated only 0.4 ha and 0.8 ha, respectively, those in Somali and Oromia cultivated 2 ha and 1.8 ha, respectively. However, while the yields were 45.3 qt and 14.7 qt in Amhara and Oromia, respectively, they were 5.5 qt and 6.9 qt in Somali and Dire Dawa (Table 3.8).

The average area of cultivated land for pulses was 1.5 ha, while the average productions per plot and yield were 3.2 qt and 24 qt, respectively. Farmers in Gambela and Dire Dawa did not produce pulses in 2020. In addition, we observed no significant variation in the average area of land cultivated across the regions, except for Oromia where the average cultivated area of land was 2.34 ha. The yield was highly variable across the regions, at 58.2 qt in Amhara and 0.2 qt and 2.2 qt in Somali and SNNPR, respectively.

Oilseeds were cultivated on 1.6 ha of land, on average, while average plot-level production and crop productivity were 4.8 qt and 3.1 qt, respectively. Farmers in Gambela did not produce oilseeds in 2020. The average area of cultivated land was relatively more significant in Oromia and the SNNPR (2.8 ha and 2.4 ha, respectively) and smaller in Amhara and Dire Dawa (0.7 ha and 1 ha, respectively). As in the case of pulses, the yield was extremely variable among the regions, ranging from 5.5 qt in Amhara to 0.5 qt in Dire Dawa.

The average area of land on which vegetables were cultivated was relatively smaller at 1 ha , while their average plot-level production and yield were 10.3 qt and 12.7 qt, respectively. The average cultivated land area was relatively bigger in Oromia and Somali (2.7 ha and 1.6 ha, respectively) and smaller in the SNNPR and Amhara, at about 0.8 ha each. The yield was somewhat bigger in Amhara (12.7 qt) and smaller in Gambela and Oromia (2.5 qt and 3.3 qt respectively). Despite cultivating 0.8 ha of land, on average, farmers in Dire Dawa produced nothing from it. Table 3.8 summarizes the findings on average cultivated area, average production per plot, and yield for crops produced overall and in each region in 2020.

Table 3.8: Average cultivated area, average production per plot and yield of crops

Regions	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Total
Cereals							
Amount produced (qt)	13.5	20.6	8.0	7.3	6.9	2.2	12.8
Area cultivated (ha)	0.8	1.8	2.0	1.1	1.7	0.4	1.3
Production per hectare	45.3	14.7	5.5	8.1	8.0	6.9	19.9
Pulses							
Amount produced (qt)	2.6	5.7	1.3	1.7			3.2
Area cultivated (ha)	1.1	2.3	1.5	1.3			1.5
Production per hectare	58.2	3.3	0.2	2.2			24.0
Oilseeds							
Amount produced (qt)	7.1	2.3		4.3		0.2	4.8
Area cultivated (ha)	0.7	2.8		2.4		1.0	1.6
Production per hectare	5.5	1.0		2.3		0.5	3.1
Vegetables							
Amount produced (qt)	10.3	7.2	4.4	5.5	2.6	0.0	7.3
Area cultivated (ha)	0.8	2.7	1.6	0.8	1.3	0.8	1.0
Production per hectare	12.7	3.3	4.2	6.0	2.5	0.0	7.7
Root crops							
Amount produced (qt)	30.5	42.4	19.2	6.8	2.2		21.1
Area cultivated (ha)	0.9	2.3	1.8	1.1	1.2		1.4
Production per hectare	30.0	34.0	15.9	13.4	2.1		21.7
Spices							
Amount produced (qt)	2.7	3.7		6.1			5.5
Area cultivated (ha)	0.9	1.1		2.1			1.9
Production per hectare	3.4	3.0		6.5			5.8
Cash crops							
Amount produced (qt)	5.8	7.7	0.6	8.3	9.8	0.3	7.1
Area cultivated (ha)	0.7	1.7	1.2	1.4	1.9	0.5	1.4
Production per hectare	19.0	7.7	0.5	11.8	8.0	1.0	10.1
Fruits							
Amount produced (qt)	68.8	26.7	15.3	9.7	11.0		16.1
Area cultivated (ha)	0.7	2.9	1.9	0.9	1.8		1.3
Production per hectare	72.1	18.1	12.0	14.7	7.1		16.8
Others							
Amount produced (qt)	0.2	0.1	0.0	0.4	0.0		0.2
Area cultivated (ha)	1.1	2.0	1.0	1.0	1.2		1.4
Production per hectare	1.9	0.3	0.0	0.4	0.0		1.2
Total							
Amount produced (qt)	11.4	16.1	8.9	7.0	8.2	1.5	10.6
Area cultivated (ha)	0.9	2.0	1.7	1.1	1.7	0.5	1.3
Production per hectare	34.8	11.8	7.6	9.6	7.4	4.8	16.6

Source: Own computation based on RCC Survey 2021

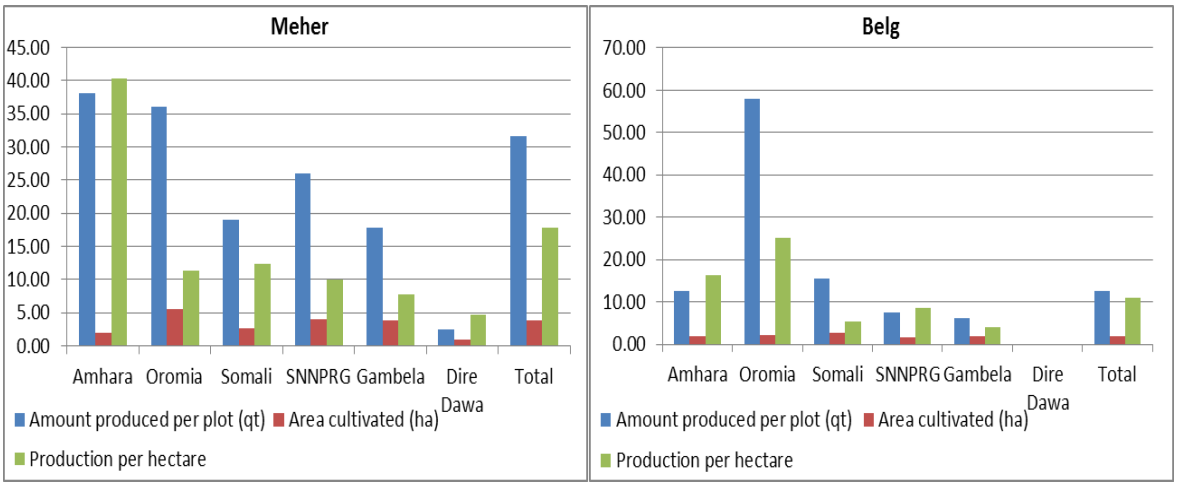
PLOT-LEVEL CROP HARVEST

We conducted our descriptive analysis of crops harvested by farm households based on seasonal variations and crop types. Average production measures were computed for each cultivated plot and converted into their per hectare equivalents.

During 2020, a typical farm household produced an average of 27.8 qt per plot and 16.6 qt per hectare and cultivated a total of 3.4 ha of land.[2] There were significant variations across regions in both crop productivity (per hectare) and cultivated area (total average) (Figure 3.10). For example, while crop productivity was 34.8 qt in Amhara, it was 4.8 qt in Dire Dawa. Similarly, the average total cultivated area in Oromia and Gambela was 5.4 ha and 3.7 ha, respectively, but 0.9 ha and 1.9 ha in Dire Dawa and Amhara, respectively.

Further detailed observation shows significant variations in the average total area cultivated by farm households during the two seasons. In the Meher season, average cultivated areas were larger in Oromia (5.5 ha vs 2.2 ha), SNNPR (4.0 ha vs 1.8 ha), and Gambela (3.9 ha vs 1.9 ha) but were slightly smaller in Somali (2.6 ha vs 2.8 ha) and Amhara (2 ha vs 1.9 ha). Farmers in Dire Dawa neither cultivated nor harvested during the Belg season. Similarly, variations were observed in crop productivity and production per plot during the two harvest seasons. Overall, farm households in all regions except Oromia had higher crop productivity and production per plot during the Meher season. Figure 3.9 summarizes the findings on average crop harvest per plot and per hectare as well as the average area cultivated by farmers overall and separately during the two harvest seasons.

Figure 3.9: Crop production per plot, yield, and average cultivated area during Meher and Belg

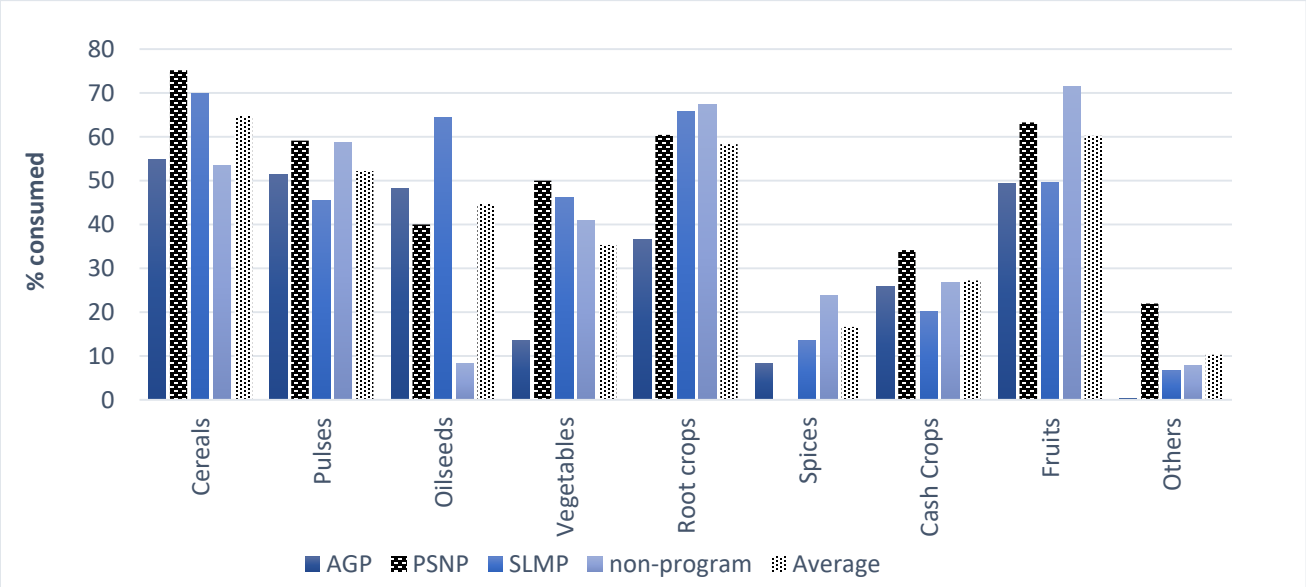


Source: Own computation based on RCC Survey 2021

[2] This implies that the land was used multiple times during the Meher and Belg seasons.

As Figure 3.10 shows, households living in the SLMP Woredas consumed more oilseeds, root crops, and cereals, while consumption of cereals was highest in the PSNP Woredas. A plausible reason for this may be in-kind payment of cereals for PSNP participants.

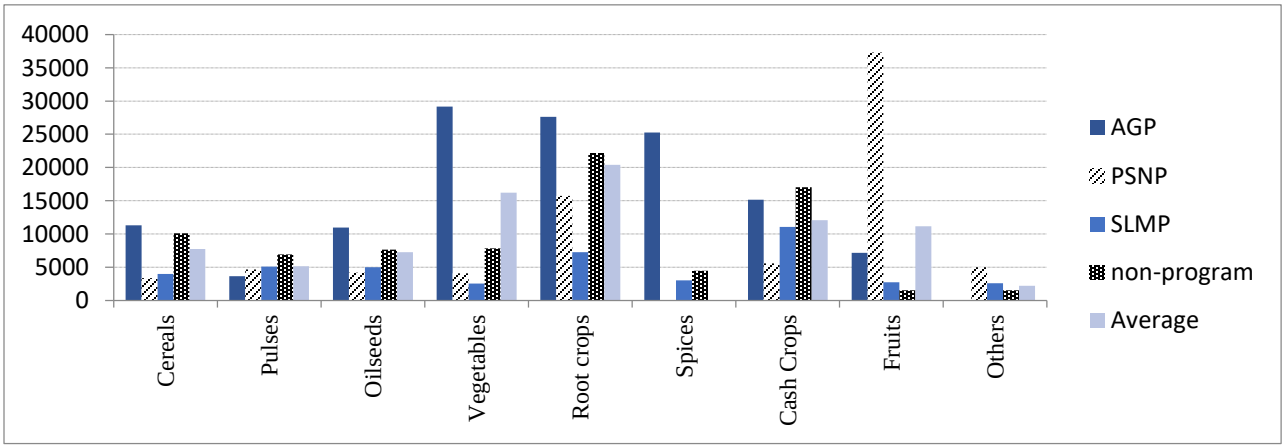
Figure 3.10: Consumption, by programme and crop category (percent)



Source: Own computation based on RCC Survey 2021

The value of the sale of fruits was highest in PSNP Woredas, while those in AGP Woredas reported higher values of sales of vegetables, root crops, and spices (Figure 3.11).

Figure 3.11: Value of sales, by programme and crop category



Source: Own computation based on RCC Survey 2021

HARVEST CHARACTERISTICS AND ASSOCIATED CHALLENGES

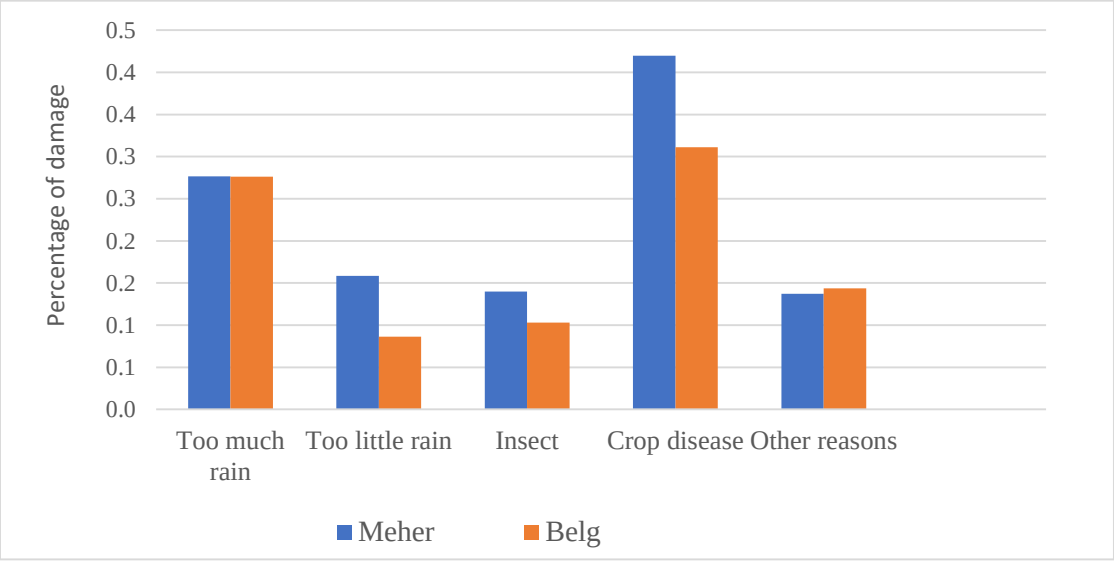
In this section, we discuss the experiences of farmers' post-harvest practices and the associated challenges. We conducted the analysis along with crop types for the two harvest seasons in 2020.

A study by the Food and Agriculture Organization (FAO) (FAO, 2017) on post-harvest losses of cereal crops indicated that harvest losses of 15 percent to 27 percent (depending on crop type) are experienced in Ethiopia. We observed whether the area harvested was less than the area planted and whether crop damage had occurred. Regarding differences in the areas planted and harvested, the proportion of farmers whose harvested area had decreased was higher during Belg than Meher (and for all crop types). During Belg, the decline was widespread among farmers who harvested oilseeds (100 percent) and spices (55 percent). Among farmers who produced cereals and pulses, during Meher 14 percent and 11 percent, respectively, had experienced a decline in their area harvested.

With regard to crop damage, for all crops harvested except root crops, a more significant proportion of the farmers had experienced crop damage during Meher than Belg. During the Meher season, crop damage was prevalent among farmers who harvested oilseeds (64.9 percent), cereals (51.7 percent), pulses (48.4 percent), and spices (48.2 percent). During Belg, crop damage was more common among farmers who produced oilseeds (50 percent) and pulses (46.8 percent). A relatively smaller proportion of farmers (26 percent) who produced root crops had experienced crop damage during Meher. In comparison, a smaller proportion of farmers (19 percent and 27 percent, respectively) who produced fruits and cash crops had experienced crop damage during Belg. The main reasons for crop damage were plant disease, too much rain, lack of rain, and insects. During Meher, plant disease was more prevalent among producers of fruits (66 percent), cash crops (66 percent), and vegetables (53 percent), while it was more prevalent during Belg among producers of spices (88 percent), fruits (60 percent), and vegetables (47 percent). Too much rain was a common reason for crop damage among farmers who produced spices (32 percent), cereals (26 percent), and pulses (26 percent) during Meher, while, during Belg, it was more prevalent among those who produced oilseeds (100 percent) and cash crops (38 percent). A lack of rain was common among producers of root crops (31 percent) and cereals (30 percent) during

Meher, whereas insects mainly affected producers of vegetables (31 percent) and pulses (30 percent) during Meher and cash crop producers (25 percent) during Belg.

Figure 3.12: Main reasons for crop damage during Meher and Belg



Source: Own computation based on RCC Survey 2021

Regarding rainfall distribution, we captured farmers' experiences of whether there had been sufficient rainfall during the starting and growing periods and whether the rain had stopped on time and/or had continued during harvest time. Tables 3.9 and 3.10 summarize the farmers' experiences of rainfall distribution during the Meher and Belg seasons. The great majority (85 percent or more) of producers of each main crop type generally stated that rainfall had come on time during the Meher season (Table 3.10). About three-quarters of the fruit and root crop producers and about two-thirds of cash crop and vegetable producers reported that rainfall had come on time during the Belg season. All producers of spices and about 85 percent of producers of cereals and pulses indicated that rainfall had come on time during the Belg season. Similarly, about 85 percent or more of the farmers stated that there had been sufficient rainfall during Meher alone. In comparison, about 80 percent (but 89 percent and 91 percent, respectively, in the case of pulse and oilseed producers) said there had been sufficient rainfall during the growing season. However, the figures dropped further when it came to the proportion of farmers who had experienced rainfall stopping on time during the Meher season. While about 70 percent or more of producers of root crops, spices, and fruits had experienced rainfall stopping on time, about 55 percent of producers of cereals, vegetables, and oilseeds had had the same experience during the

Meher season. During Meher, rainfall at harvest time was rare. Only a quarter or less of the farmers had experienced rainfall at harvest time. There was no significant difference in the share of farmers who had experienced rainfall stopping on time at harvest time during the Belg season.

Finally, it is worth mentioning that no farmers had purchased rainfall insurance for their crops for either the Meher or Belg harvests, apart from cash crop producers during Meher and Belg (20 percent and 7 percent, respectively) and cereal producers (9 percent) during Meher.

Table 3.9: Rainfall distribution and crop insurance purchase – Meher season

Proportion of farmers who stated:	Meher season								
	Cereals	Pulses	Oilseeds	Vegetables	Root crops	Spices	Cash crops	Fruits	Others
Rainfall had come on time	0.9	0.9	1.0	0.8	0.9	0.9	0.9	0.9	0.1
Rainfall had been enough at the beginning	0.8	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.1
Rainfall had been enough during growing period	0.8	0.9	0.9	0.8	0.8	0.9	0.8	0.8	0.1
Rainfall had stopped on time	0.5	0.8	0.6	0.6	0.7	0.7	0.6	0.7	0.1
Raining during harvest time	0.2	0.2	0.3	0.2	0.1	0.2	0.3	0.2	0.2
Had purchased rainfall insurance	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0

Source: Own computation based on RCC Survey 2021

Table 3.10: Rainfall distribution and crop insurance purchase – Belg season

Proportion of farmers who stated	Belg season								
	Cereals	Pulses	Oilseeds	Vegetables	Root crops	Spices	Cash crops	Fruits	Others
Rainfall had come on time	0.8	0.9	0.0	0.7	0.7	1.0	0.7	0.8	0.1
Rainfall had been enough at the beginning	0.8	0.9	0.0	0.7	0.7	1.0	0.7	0.7	0.2
Rainfall had been enough during growing period	0.7	0.8	0.0	0.6	0.7	0.9	0.6	0.7	0.1
Rainfall had stopped on time	0.5	0.6	0.0	0.4	0.5	0.6	0.4	0.7	0.1
Raining during harvest time	0.3	0.2	0.0	0.2	0.3	0.2	0.4	0.3	0.1
Had purchased rainfall insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0

Source: Own computation based on RCC Survey 2021

A serious constraint to agricultural development in many African countries is limited access to agricultural information. In Ethiopia, the agricultural extension service is an institutional support service, which plays a central role in the agricultural transformation process (Gebremedhin et al., 2006). Extension services refer to a household's access to agricultural services. Extension services are a crucial source of information on agronomic practices as well as on climate. Access to information on climate change through extension agents is believed to create awareness and favourable conditions for adopting farming practices suited to climate change (Maddison, 2007). It is believed that the availability of better climatic and agricultural information helps farmers to make comparative decisions about alternative adaptation options, enabling them to cope better with changes to the climate. Of the different extension services provided, 85.7 percent of rural households used the fertilizer application service in their farming activities, while 66 percent and 29 percent used the modern seed variety and pest/disease control extension services, respectively (Table 3.11). The table shows that application of climate change adaptation practices was very low (7.8 percent) among farming households.

Table 3.11: Extension service provision

Extension service types	Number of obs.		% of applications	
	Yes	No	Yes	No
Modern crop variety	782	403	66.0	34.0
Fertilizer use	1,015	170	85.7	14.4
Climate change adaptation	92	1,093	7.8	92.2
Pest/disease control	339	846	28.6	71.4
Livestock production	164	1,021	13.8	86.2
Tree planting	820	365	69.2	30.8

Source: Own computation based on RCC Survey 2021

Table 3.12 shows that about 28.6 percent and 22 percent of farm households employed sustainable agricultural practices and agricultural water-management practices on their farm.

Table 3.12: Sustainable agricultural practices, water management, and market prices

	Number of obs.		% of applications	
	Yes	No	Yes	No
Agricultural water management	260	925	21.9	78.1
Sustainable agricultural practices	339	846	28.6	71.4

Source: Own computation based on RCC Survey 2021

Having access to an agricultural extension service was considered a major source of information about agricultural activities and natural resource conservation for farming households. It was believed that extension contacts had a positive effect in that farmers who

had had contact with extension agents had tended to adopt adaptation measures in response to the changing climate. Of the households in our sample that had received extension services, about 22 percent, 13.3 percent, and 13 percent had received extension services every six months, four months, and one month, respectively (Table 3.13). The data also indicates that about 38.4 percent of farm households believed that the extension service was beneficial.

Table 3.13: Frequency of extension services

Frequency of meeting extension agent	Freq.	%
Every week	79	6.7
Every 2 weeks	116	9.8
Every month	149	12.6
Every 2 months	109	9.2
Every 3 months	128	10.8
Every 4 months	157	13.3
Every 5 months	91	7.7
Every 6 months	259	21.9
Every year	97	8.2

Source: RCC Survey 2021

The proliferation of mobile phone-based services in the agricultural sector helps to provide information on market prices, weather, transport, and agricultural techniques via voice SMS, radio, and the internet (Aker, 2011).

Table 3.14 shows that 63.7 percent of households in our sample owned mobile phones. However, while many farmers owned mobile phones, the number of those who used their mobile phones to search for information was very small. This was mainly due to the limitations of mobile phone-based services such as voice and SMS messaging services. Only about 2 percent of the households sampled used interactive voice response/short messaging services (IVR/SMS), which shows that there is a huge gap in information sharing and the provision of extension services using modern technologies.

Table 3.14: Mobile phone ownership and advice through IVR

		Freq.	%
Mobile phone ownership	Yes	1,267	63.7
	No	723	36.3
Got advice through IVR	Yes	29	2.3
	No	1,239	97.7

Source: Own computation based on RCC Survey 2021

FERTILIZER AND IMPROVED SEED USE

The main extension package services provided to farmers were the provision of fertilizer, improved seeds, and pesticides (chemicals). Although the adoption of agricultural inputs such as fertilizer and improved seeds has risen over the past decade in Ethiopia, it is low compared to other developing countries (Byerlee et al., 2007; Spielman et al., 2011). A number of interacting poverty and productivity traps are constraining the wider use of agricultural inputs. These are the limited availability and high cost of inputs, lack of varieties suitable for farmers' needs, the low level and high variability of crop yields, and erratic and insufficient rainfall. In many developing countries, limited access to formal financial services (i.e. credit, saving, and insurance) and lack of formal credit facilities are often significant impediments to the adoption of improved agricultural inputs (Carter, 2013; Feder et al., 1985).

On average, households used 157 kg of fertilizer, 51 kg of modern seeds, 45 kg of traditional seeds, and 4 litres of agrochemicals (Table 3.15).

Table 3.15: Average quantity of inputs for 2012/13 cropping season

Input type	Obs.	Mean	SD
Fertilizer (Kg)	1,988	157	362.4
Modern seeds (Kg)	1,988	51	801.8
Traditional seeds (Kg)	1,988	45	352.0
Agrochemicals (Lit)	1,988	4	74.6

Source: Own computation based on RCC Survey 2021

The average cost of agricultural inputs such as fertilizer was about ETB 2,223. Likewise, on average, farm households paid ETB 521 and ETB 453 for modern and traditional seeds, respectively (Table 3.16). The table further shows that households spent on average about ETB 390,317 and ETB 3,029 for agrochemicals, machinery, and hiring labour, respectively.

Table 3.16: Average cost of inputs in ETB for the 2012/13 cropping season

Variable	Obs.	Mean	SD
Fertilizer	1,988	2,223	3,538.6
Modern seeds	1,988	521	2,653.2
Traditional seeds	1,988	453	1,633.5
Agrochemicals	1,988	390	1,264.0
Machinery	1,988	317	2,379.3
Labour	1,988	963	3,029.0

Source: Own computation based on RCC Survey 2021

3.3 Access to Irrigation

Water stress in agriculture is well understood as being one of the global threats that will face us in 2050 (Lundqvist, 2021). Conservation of soil water and irrigated agriculture are climate-smart agricultural technology and long-run investments. In Ethiopia, investment in irrigation is made by the government, non-governmental organizations, individuals, or groups of farmers. Until now, the investment has been extremely low and, because of this, the proportion of households using irrigation and the proportion of irrigated land are extremely low. The proportion of irrigated land was about 10 percent for a long time until 2016. This means that the proportion of irrigated plots occupied by smallholders is low.

The survey data shows that the percentage of households in our sample who used irrigation computed from the survey data was 14.8 percent, compared to about 6 percent in 2011 and 2012 (World Bank, 2012). As expected, the survey data indicates that irrigation was used on only 706 of 7,861 plots (9 percent). This percentage had increased compared to the 4.5 percent share in previous national data collected in 2011 (e.g. World Bank, 2012 national data). Despite the slight improvements in the proportions using irrigation, there were high regional variations, as expected. The highest proportions of irrigated plots were in Oromia (13.4 percent) and Amhara (10.8 percent) and the lowest was in SNNPR (3.1 percent). The percentage of irrigated plots in Somali in our sample was high (44.6 percent). This is surprising because, with the increasing risk of climate change, crop growing with irrigation is extremely important in an arid environment and must be encouraged. Unlike in the Somali region, there was almost no use of irrigation in Dire Dawa (3.2 percent) and Gambela. This data is similar to previous data for the proportion of irrigated land.

The proportion of irrigated plots by programme Woredas is also worth analysing. As expected, the proportion of households which used irrigation was highest in AGP Woredas (14.9 percent of the total number of plots), followed by non-programme Woredas (8.9 percent), PSNP Woredas (6.4 percent), and SLMP Woredas (5.9 percent). The SLMP Woredas are not supported by irrigation, but irrigation should be encouraged in those Woredas.

The survey data indicates that of the 295 households in our sample which used irrigation, 158 households (53.6 percent), 78 households (26.4 percent), 48 households (16.3 percent), ten households (3.4 percent), and one household (0.3 percent) were in the Amhara, Oromia, Somali, and SNNPR regions and Dire Dawa, respectively.

Following the questions about irrigation use and plot, the households were asked which year they had started to use irrigation. Our data indicates that 70.5 percent of the user

households reported using irrigation between 1998 and 2020. This is consistent with the huge promotion of small and micro-irrigation (e.g. rainwater harvesting) since 1998. Following this promotion, the irrigation outlays of the AGP in all micro, small, and medium-scale irrigations seems to have contributed to a 45 percent increase in the number of irrigation users after 2007. In the sample areas of Somali, such as Shinile, many farmers used irrigation, which may have increased the percentage of users.

A related question to the use of irrigation was whether the household used any agricultural water-management practices. Only 460 households (5.9 percent) reported practising water management. By programme, the largest proportion of plots where water management was practised was found in PSNP Woredas (8 percent), followed by AGP Woredas (6.7 percent), and SLMP (6.22 percent), and the least was found in non-programme Woredas (2.5 percent) where there was low coverage of this practice. Our descriptive analysis shows that the proportions of all crop plots with agricultural water-management practices were highest in the Somali and Amhara regions (60 percent and 7.6 percent, respectively).

The households in our sample which used irrigation were asked what types of irrigation technologies (source and conveyance) they used. In responding, 280 of the 295 irrigation users (94.9 percent) reported that they used one type of irrigation technology, whereas the remaining 15 (5.1 percent) used multiple[3] irrigation technologies (Table 3.17). The types of irrigation technologies are indicated from the most to the least used and discussed.

[3] All but one of the multiple irrigation users were in either the Amhara or Oromia region.

Table 3.17: Types of irrigation technology

No.	Type of irrigation technology	No. of users	% of total
	Users of single irrigation technology		
1.	Dam/weir communal irrigation	79	26.8
2.	Drip irrigation	6	2.0
3.	Pump irrigation	42	14.2
4.	Hand-dug wells	11	3.7
5.	Individual water-harvesting ponds	3	1.0
6.	Community ponds	8	2.7
7.	Low-cost drilling technologies	7	2.4
8.	On-farm irrigation water management	54	18.3
9.	Furrow based	63	21.4
10.	Others	4	1.4
	Total	280	94.9

Source: Own computation based on RCC Survey 2021

Irrigated crop growing must be complemented by proper and efficient equipment. In their responses to the question in the asset section, 38 households reported owning either mechanical or motorized pumps, which is low when compared to the number of irrigation user households. One of the important questions irrigation users were asked was about their use of motorized pumps, which requires encouragement from stakeholders (the government and the private sector).

When looking at the regional distribution of these irrigation technologies, we see that almost all types of irrigation were used in the Amhara and Oromia regions. In Somali, on-farm irrigation water management was used by 44 of the 48 (91.6 percent) households. Overall, in the arid and semi-arid environments where climate change is a challenge, few farmers used water-saving irrigation technologies such as drips and sprinklers.

The entire sample of households were asked whether the household head/member had training in irrigation use. Only 273 of the 1,990 households (13.7 percent) had undergone training in irrigation. This indicates that there is an institutional gap in increasing the efficiency of irrigation use. Irrigation training could increase the number of households choosing economically efficient irrigation technology, ex ante, and crop and water use efficiency and adequate maintenance of irrigation schemes, ex post. Our descriptive analysis indicates that households in AGP Woredas had the highest proportion of training (29.8 percent of all households), followed by SLMP Woredas (13.5 percent), non-programme Woredas (9.3 percent), and PSNP Woredas (6.4 percent), which had the least.

The last survey question in the irrigation section was about the challenges faced by farmers in using irrigation. As a first challenge, the most frequently reported problem (reported

by 186 households) was the shortage of irrigation water sources (59.2 percent of responding households), followed by a lack of motor pumps and conflict in water use. Among those which reported second and third problems, conflict related to water, a lack of motor pumps and conveyance equipment, and a lack of advice on irrigation were major challenges. This indicates that investment in irrigation must be accompanied by increasing access to irrigation equipment, decreased conflict, increased advice and training, and so on. With increasing water shortages, the conflict issue could lead to a decrease in the benefits of irrigation. The lack of motor pumps is a serious challenge in the Somali region, where irrigation could be employed by using motor pumps to get water from the rivers.

The households in our sample were asked whether they used rainwater harvesting/irrigation as a long-run resilience tool to mitigate climatic shocks. About 306 households responded that they had started to use this practice, indicating the positive role of at least one type of irrigation.

3.4 Livestock

Livestock rearing is a major source of livelihood in both the high- and lowlands (i.e., pastoral regions). It helps minimize the risks facing smallholder farming-households and provides opportunities for additional income (Mekuria and Mekonnen, 2018; Rodriguez and Anderson, 1988). The mixed mode of production is dominant in the highlands and non-pastoral areas of the country. For instance, among the 2,000 sample households, 1,781 or 89 percent belong to a mixed farming system, indicating that crop-livestock production is the dominant production system for which the majority of farmers opt, in part with a view to cope with different forms of risks (i.e., weather, disease, and price risks). The average livestock ownership per farming household varies across regions (see Table 3.18).

Aggregate ownership of cattle (oxen, caw, heifer and calves) is the highest in Somali followed by the Oromia, Amhara and SNNP regions. Similarly, shoats (sheep and goat) ownership is the highest in the Somali region, followed by Oromia and Amhara. The ownership of shoats in Somali is close to three times that in Amahara and Oromia. Dwindling feed availability and grazing shortages coupled with prevalence of disease, have forced farmers in pastoral regions to tilt towards rearing more small ruminants rather than cattle. This is one of the coping strategies of households in the region to help build resilience to climate change.

Table 3. 18: Farm Households' Livestock Ownership by region (Numbers/HH)

Livestock ownership (Number)	Amhara		Oromia		Somali		SNNPR		Gambella		Dire Dawa		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bulls/oxen	1.64	0.04	2.22	0.07	1.76	0.37	1.43	0.06	1.63	0.26	0.75	0.18	1.77	0.03
Young bull	1.24	0.04	1.87	0.09	1.50	0.21	1.33	0.09	1.00	0.58	1.22	0.28	1.53	0.05
Cows	1.46	0.05	2.26	0.12	2.84	0.34	1.55	0.05	1.00	0.12	1.46	0.15	1.81	0.05
Heifer	1.41	0.06	1.82	0.07	2.00	0.50	1.34	0.05	1.38	0.26	1.00	0.00	1.56	0.04
Calves	1.40	0.04	1.69	0.07	2.16	0.17	1.40	0.04	1.09	0.09	1.20	0.13	1.52	0.03
Sheep	4.36	0.26	5.22	0.34	15.73	2.39	2.42	0.11	2.22	0.49	2.47	0.56	4.55	0.22
Goats	4.63	0.36	3.79	0.28	10.12	1.23	2.68	0.18	5.07	0.84	4.27	0.75	4.39	0.21
Camel	1.60	0.40	_	_	4.33	1.67	_	_	_	_	2.33	0.88	2.55	0.59
Horses	1.23	0.09	1.37	0.07	_	_	1.11	0.06	_	_	_	_	1.26	0.04
Mules	0.96	0.04	0.67	0.21	_	_	1.14	0.14	_	_	_	_	0.92	0.06
Donkeys	1.35	0.04	1.41	0.04	1.58	0.17	1.08	0.03	1.00	0.00	1.10	0.07	1.33	0.02
Poultry	6.31	0.32	7.08	0.34	8.00	2.41	4.04	0.21	11.04	2.33	3.50	0.44	6.01	0.20

Source: Own computation based on RCC Survey 2021

Donkey ownership per farm household is highest in Somali, whereas ownership of mule, horse and camel is highest in SNNP, Oromia, and Somali, respectively. Poultry ownership per farming household is highest in Gambella followed by Somali, Oromia, Amhara and SNNPR. Overall, Somali has the highest livestock population per household compared to all other regions, and it is a major source of income for the region's livelihood.

Livestock ownership contributes to family livelihood in multiple ways. It ensures the family has access to high value livestock products (i.e., meat, milk, butter, eggs); augments family cash income from dairy products, eggs, and chickens, and sales of small ruminants; and provides employment, food and nutrition security, etc.

The survey data on average income from annual sales is depicted in Table 3.19, which shows that income varies among regions, livestock type and between pastoral and non-pastoral (highland regions) region. Income from sales of bulls/oxen is the highest in Somali, followed by Oromia, Dire Dawa, Amhara and SNNPR. The same is true for income from the sales of shoats where Somali is the highest, followed by Oromia and Amhara. Average annual income from camel sales is the highest in Somali and about half of Somali in Amhara. Farm households in the rest of the regions did not report any income from camel sales.

Table 3. 19: Average Annual Farm Household Income from Livestock Sales (000' ETB)

Livestock sales income (ETB, annual)	Amhara		Oromia		Somali		SNNPR		Gambella		Dire Dawa		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bulls/oxen	16.11	635.7	21.72	1446.7	35.50	8995.4	10.91	1572.7	11.83	1691.5	17.33	2666.7	16.68	653.5
Young bull	8.95	1060.6	11.65	2449.7	10.00	.	3.77	630.5	--	--	--	--	7.11	723.4
Cows	10.68	1162.8	13.98	2259.1	9.27	371.2	5.53	1162.4	12.00	2000.0	7.50	500.0	9.62	835.7
Heifer	6.70	1217.9	10.93	2824.3	--	_	2.99	656.3	3.00	--	7.00	0.0	6.36	968.3
Calves	2.78	536.1	9.25	4750.0	--	_	1.50	516.5		_		_	2.35	491.2
Sheep	5.60	737.0	7.63	780.0	9.18	1390.8	1.02	204.3	4.64	798.5	2.33	675.0	5.90	438.8
Goats	4.84	610.6	5.89	1377.0	9.73	1302.1	1.20	277.1	4.23	704.9	3.93	515.1	4.85	402.4
Horses	2.05	1096.0	5.46	1944.8	--	_	--	_	--	_	--	_	1.84	659.2
Mules	3.00	1914.9	10.50	--	--	_	--	_	--	_	--	_	0.98	576.6
Camel	25.50	14924.8		_	51.00	20108.0	--	_	--	_	--	_	10.20	4637.2
Donkeys	1.99	209.4	2.79	444.4	--	_	--	167.7	--	--	--	_	1.70	198.1
Poultry	0.90	90.0	1.01	66.5	--	--	--	103.0	--	210.6	0.42	64.9	0.87	49.0

Source: Own computation based on RCC Survey 2021

With regard to average buying and selling prices, the price of oxen was the second highest (after camels). This is because, whether they are used for ploughing or for fattening, the use of oxen as a capital good or source of beef is greater than the case of other cattle. The average buying prices of oxen, cows, sheep, goats, and chickens were highest in Oromia, and goats and donkeys had the highest prices in the Amhara region. The average selling prices of oxen and goats were highest in Somali, while they prices of cows, sheep, and donkeys were highest in Oromia, and the price of chicken was highest in Gambela. The data seems to reflect the supply and demand situation, especially in Oromia and Somali where, in Oromia, the Addis Ababa market is influential. In contrast, in the case of Somali, the selling prices may favour the export market, making the Somali region's net income one of the highest (Table 3.20).

Households were asked whether they had sold livestock to minimize the impact of the drought. Of the 480 households which responded to this question, 264 (55 percent) reported having sold their livestock.

Table 3.20: Average prices of livestock bought and sold (ETB/head)

Type of livestock	Average buying prices in 2021		Average selling prices in 2021	
	Mean	SD	Mean	SD
Bulls/oxen	17,254	617	17,692	617
Young bulls	10,673	990	9,156	990
Cows	12,804	1,047	11,520	1,050
Heifers	9,443	1,313	8,219	1,313
Calves	4,124	403	4,055	403
Sheep	4,127	340	6,373	340
Goats	2,659	303	5,437	303
Horses	4,694	901	4,471	901
Mules	5,167	1,947	7,500	1,947
Camels	61,000	-	51,000	-
Donkeys	25,20	127	2,399	127
Poultry	451	60	926	60

Source: Own computation based on RCC Survey 2021

Rearing livestock requires the viability of grazing, feed, and water. The households in our sample were also asked about the current availability of grazing land compared to in the past. The data shows that 1,198 of the 1,993 households (nearly 60 percent) reported that availability was poor, whereas only 373 households (18.7 percent) reported it as being good, demonstrating the challenges associated with grazing land. Similarly, the households were asked whether they used modern feed, and only 246 households (12.3 percent) reported that they did. These households used four sources and a combination of those four sources (local market and other cities/towns) because of the limited number of feed producers. Next, they

were asked whether they had access to an improved water source for livestock. Only 588 households (25.4 percent) reported having access to an improved water source for their livestock, and, by region, those households in Oromia, SNNPR, and Gambela had greater access to improved water than those in other regions. Finally, the households were asked whether they had livestock insurance against drought. Unfortunately, just one percent of households (19 of 1,974 sample households) owned livestock insurance.

BEEHIVES

Among the sample households, 223 owned traditional, transitional, or modern beehives. The majority of households owned traditional beehives (78.3 percent), transitional (10.1 percent), and modern beehives (11.6 percent). Note that 44 sample households owned two or three types of beehives. Those households which owned traditional beehives owned between one and 200 beehives, whereas those which owned transitional and modern beehives owned between one and 12 and between one and 30 beehives, respectively. By region, the number of sample households which owned beehives in Amhara, Oromia, and SNNPR had 65, 76, and 61 respectively, whereas those in Somali, Gambela, and Dire Dawa had two, 18, and one, respectively.

We computed the average income from selling honey for the sample households (see Table 3.21). The table shows that, on average, sample households earned ETB 4,315 from selling their honey. It also shows that the households in Oromia and Amhara earned the highest average income compared to the other regions, and households in Somali and SNNPR earned the lowest average income.

Table 3. 21: Average income from honey sold, by region

Region	Average earning in ETB	SD
Amhara	5,129	858
Oromia	5,569	825
Somali	1,200	800
SNNPR	1,755	392
Gambela	4,699	955
Total	4,315	417

Source: Own computation based on RCC Survey 2021

3.5 Trees and Permanent Crops

The households in our sample produced and benefited from trees and permanent crops, although to varying degrees. Overall, about 67 percent of households had trees on at least one of their parcels of land, each with an average of 577 trees. On average, a typical farm household generated ETB 3,072 of revenue from trees over the year 2019 and 40.3 percent of the households planted trees over the same period (Table 3.22).

We found significant variations in performance among the different regions. For example, while about 75 percent of farm households in SNNPR and Gambela had trees on one of their parcels of land, only 10 percent of households in Dire Dawa had trees on at least one of their parcels of land. Similarly, the average number of trees per farm household was relatively high in SNNPR (753) and Amhara (726) but quite low in Dire Dawa (4). In addition, the average revenue generated from trees by farm households during 2019 was very high in Somali (ETB 28,167) and very low in Gambela (ETB 49.1). Finally, the share of farm households which had planted trees during 2019 was higher in SNNPR (62.6 percent) and Gambela (45 percent) but lower in Dire Dawa (2 percent).

Table 3. 22: Trees and permanent crops

Regions	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Total
HHs with trees on at least one of their parcels of land, %	69.6	59.8	62.0	75.8	75.0	10.0	67.4
Number of trees per HH	726	439	189	753	47	4	577
Revenue generated from trees ETB	1,228	2,945	28,167	1,574	49	64	3,072
HHs which had planted trees over the last 12 months, %	35.1	24.7	24.0	62.6	45.0	2.0	40.3

Source: Own computation based on RCC Survey 2021

3.6 Engagement in Non-farm Activates

Employment opportunities outside agriculture are scarce in the area covered by our study. Only 557 respondents (about 28 percent of households in the sample) participated in non-farm activities. About 36 percent of these households were engaged in selling processed foods such as local beer (*tella*), *areke*, e*njera*, Kollo, fish, flour, etc. In comparison, about 21 percent of respondents sold firewood, homemade charcoal, timber for construction, wooden poles, mats, woven baskets, animal feed (fresh grass), etc. Only about 12 percent of households owned shops, and the remaining 28 percent of households did not specify their type of business activity (Table 3.23).

Table 3.23: Annual income from non-farm enterprises

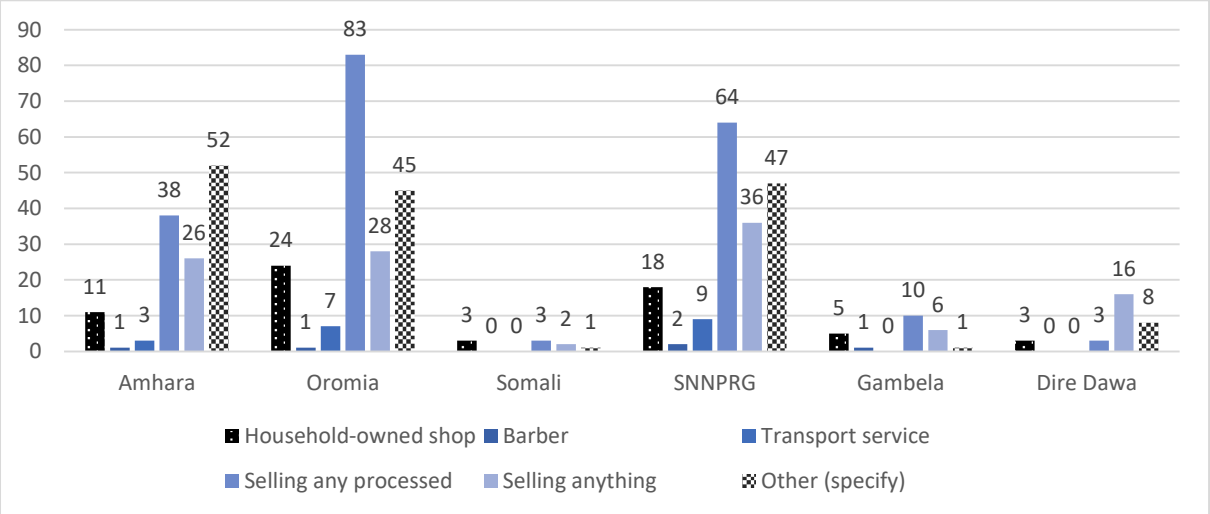
Type of non-farm enterprise	Freq.	%	Mean	Median
Household-owned shop	64	11.5	16,877	6,250
Barber	5	0.9	8,040	4,500
Transport service (motor bicycle, *bajaj*)	19	3.4	30,890	19,119
Selling any processed food	201	36.1	10,888	6,000
Selling anything on a street or in a market	114	20.5	11,114	6,000
Other (specify)	154	27.7	19,289	11,950
Total	557	100	16,183	8,970

Source: RCC Survey 2021

The average annual income from non-farm activities was ETB 16,183, with high variation across households, and thus the median income is also included in Table 3.22.

In terms of engagement in non-farm activities, by region, most households in Oromia were engaged in selling processed foods, followed by SNNPR and Amhara. Selling goods such as firewood, charcoal, construction timber, etc. ranked second in the list for Amhara, SNNPR, and Oromia (Figure 3.13).

Figure 3.13: Engagement in non-farm activities, by region



Source: Own computation based on RCC Survey 2021

About 21 percent of non-farm enterprises operated for a maximum of four months, 40 percent operated for a maximum of six months, and 49 percent operated for a maximum of nine months (Table 3.24). The remaining 48.5 percent of respondents reported engaging in non-farm activities over the whole year (i.e., for 12 months).

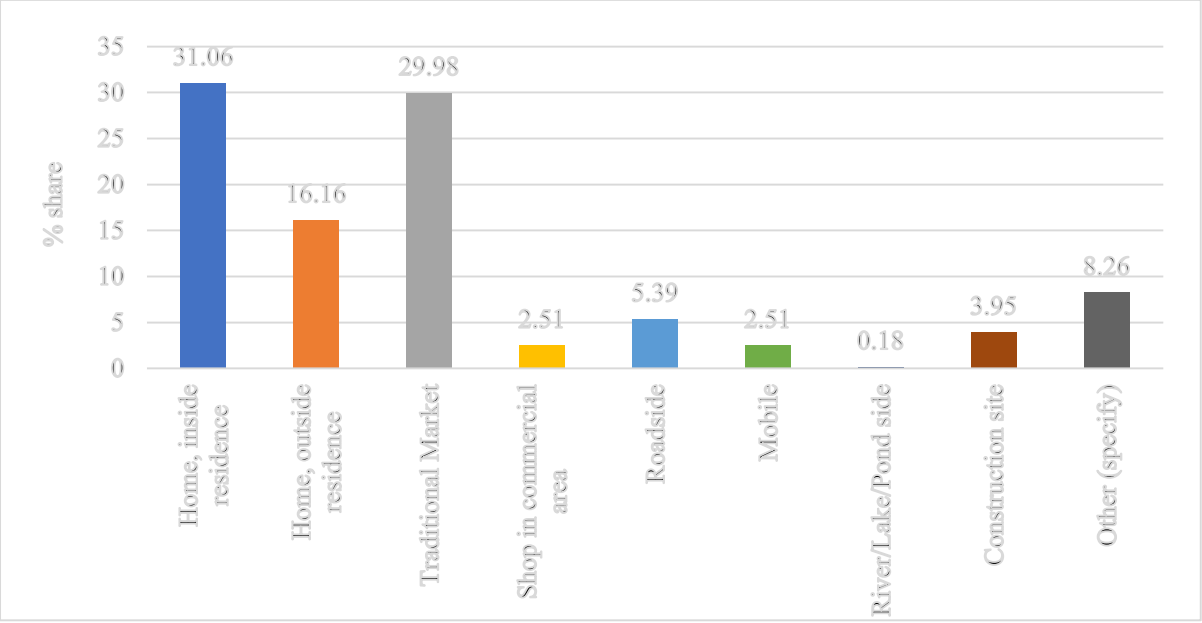
Table 3.24: Number of months the enterprise was in operation

No. of months	Freq.	%	Cum. %
1	8	1.4	1.4
2	23	4.1	5.6
3	35	6.3	11.9
4	49	8.8	20.7
5	40	7.2	27.8
6	67	12.0	39.9
7	11	2.0	41.8
8	35	6.3	48.1
9	3	0.5	48.7
10	15	2.7	51.4
11	1	0.2	51.5
12	270	48.5	100
Total	557	100	

Source: Own computation based on RCC Survey 2021

In total, 47 percent of the enterprises operated within their home, with 31 percent operating within and 16 percent operating outside the residence. About 30 percent of the participants in non-farm enterprises reported that they operated in a traditional marketplace. In comparison, only about 3 percent had a shop in a commercial area (Figure 3.14), and unspecified locations accounted for 8.3 percent.

Figure 3.14: Place where the enterprise operates



Source: Own computation based on RCC Survey 2021

Most non-farm business activities in the study area were run either by the head of household or by members. As Table 3.25 shows, 80 percent of the businesses had no hired employees. In comparison, only 15 percent of businesses had between one and five hired

employees. This demonstrates the dominance of family labour engagement in non-farm enterprises over employment opportunities for hired labour.

Table 3.25: Number of hired employees

Hired employees	Freq.	%
0	446	80.1
1-5	82	14.7
6-10	4	0.7
11-50	17	3.1
> 50	8	1.4
Total	557	100

Source: Own computation based on RCC Survey 2021

Figures 3.15 to 3.18 show the contribution made by non-farm income from household-owned shops, transport services, processed foods sales, and selling goods on the street, by programme and non-programme Woredas. Income from small shops and the sale of goods such as firewood, homemade charcoal, timber for construction, etc. contributed a great deal for households in the PSNP Woredas. In contrast, income from transport services contributed a great deal for households in the non-programme Woredas.

Figures 3.19 to 3.22 show the contribution of non-farm income generated from engagement in own shop, transport services, the sale of processed foods, and sales on the street, by region. Income from small shops contributed more to household income in Amhara, SNNPR, and Oromia (Figure 3.19), while more households in SNNPR reported that income from transport services made a significant contribution to their income (Figure 3.20). For households in Oromia and SNNPR, the contribution made by income from the sale of processed food and goods, such as firewood, homemade charcoal, timber for construction, etc., was higher than in the other regions (Figures 3.21 and 3.22).

Figure 3.15: Income share from shop, by programme

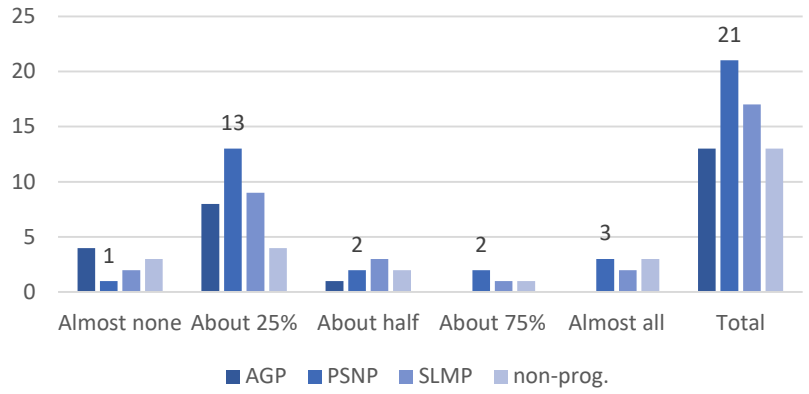


Figure 3.16: Income share from sales of processed foods, by programme

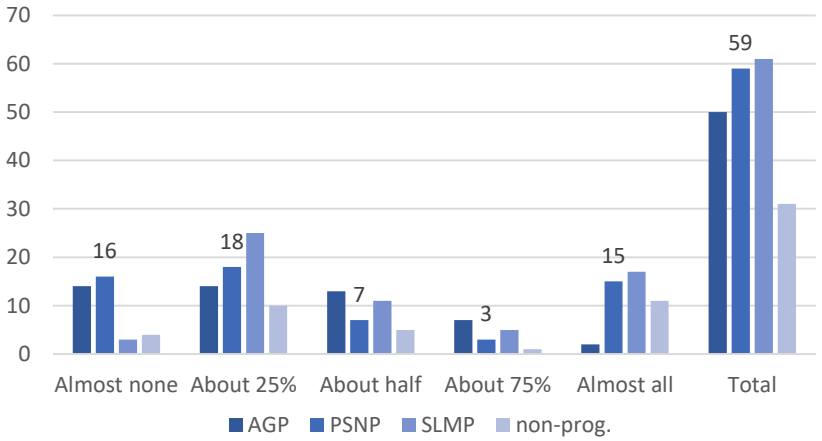


Figure 3.17: Income share from transport, by programme

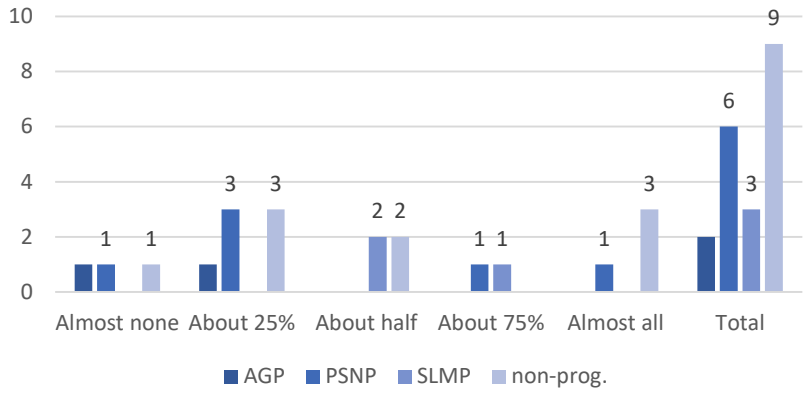
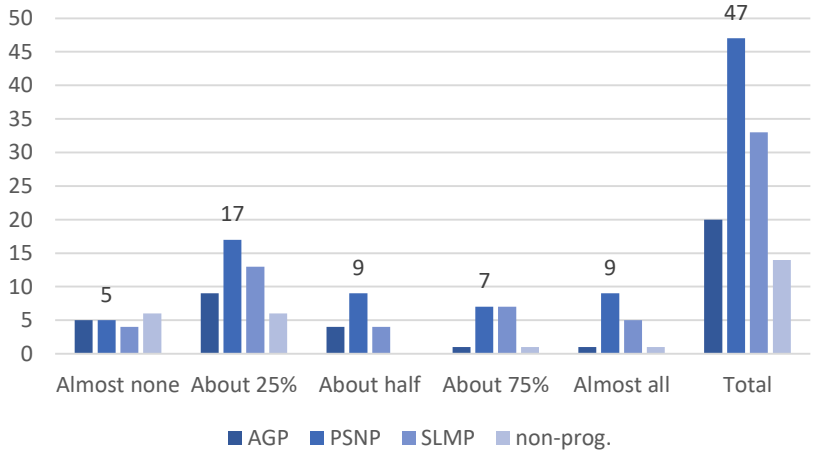


Figure 3.18: Income share from sales on the streets, by programme



Source: Own computation based on RCC Survey 2021

Figure 3.19: Income share from shop, by region

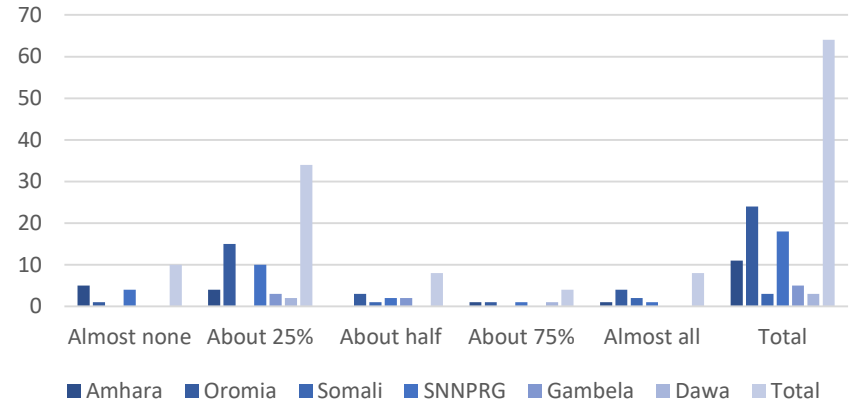


Figure 3.20: Income share from transport services, by region

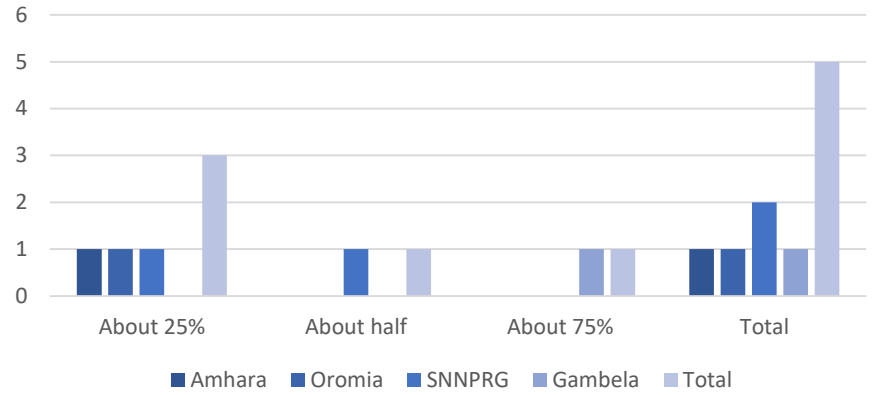


Figure 3.21: Income share from sales of processed foods, by region

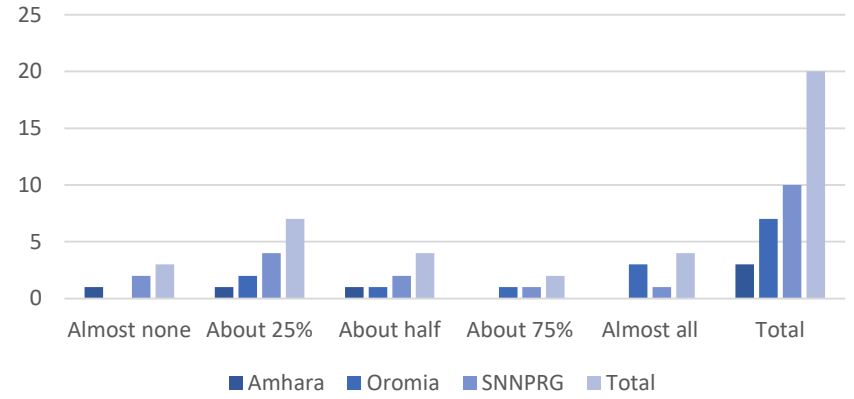
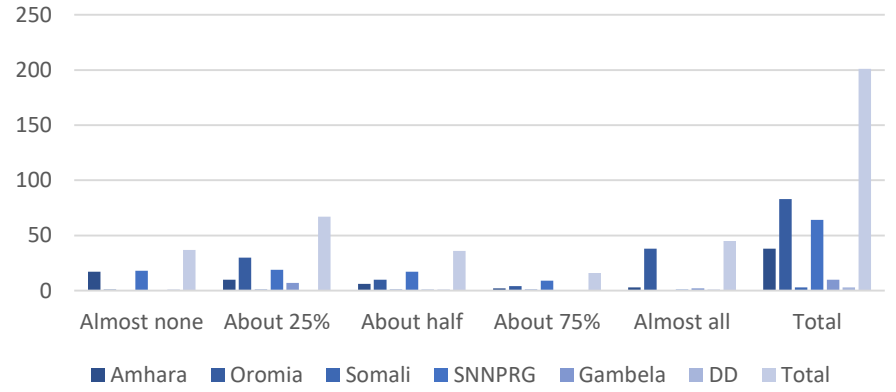


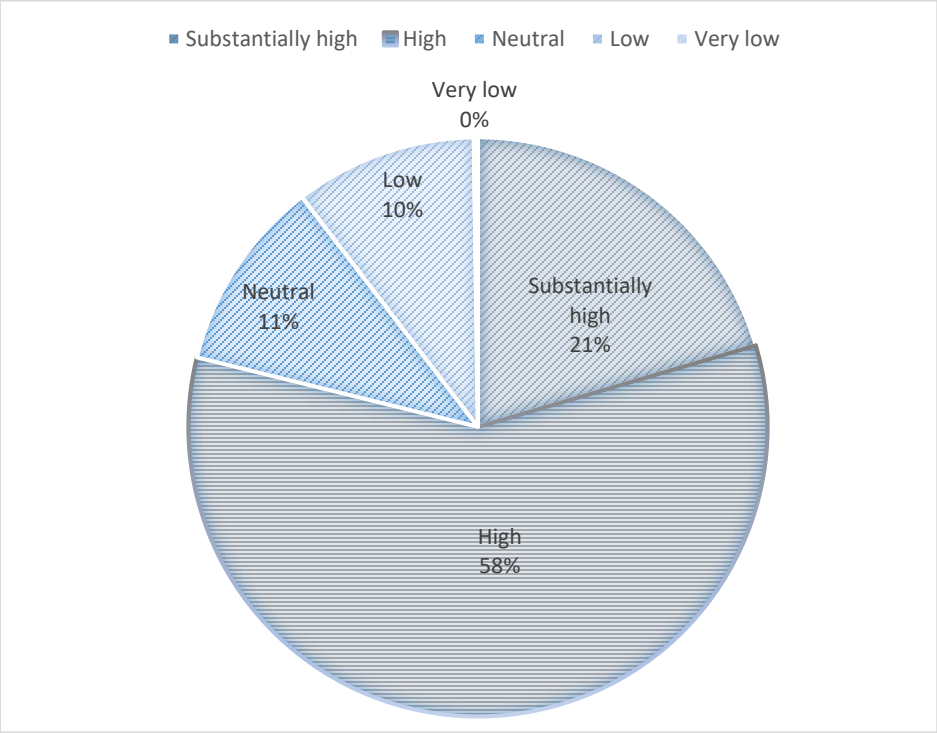
Figure 3.22: Income share from sales on the streets, by region



Source: Own computation based on RCC Survey 2021

In terms of contribution to family livelihood, about 79 percent of respondent households believed that engagement in non-farm activities made a high or very high contribution to their family livelihood (Figure 3.23). About 11 and 10 percent of respondents, respectively, were neutral or reported that they made a low contribution.

Figure 3.23: Contribution of non-farm income to family livelihood



Source: Own computation based on RCC Survey 2021

Access to financial services was reported to be the first major problem for about 38 percent of households, while lack of access to electricity and training opportunities were the other two primary challenges for households engaged in non-farm activities. About 45 percent of respondents reported that access to markets was the second most important constraint, followed by a lack of training opportunities and the high cost of time and money required to register their enterprises (Table 3.26).

Table 3.26: First and second most important constraints

First most important constraints	Freq.	%	Second most important constraint	Freq.	%
a) Access to electricity services	70	12.6	a) Access to electricity services	0	0
b) Difficulty in accessing financial services	210	37.7	b) Difficulty in accessing financial services	27	12.4
c) Access to markets	104	18.7	c) Access to markets	98	45.0
d) High cost of time and money to register enterprise	17	3.1	d) High cost of time and money to register enterprise	31	14.2
e) Lack of training opportunities	56	10.1	e) Lack of training opportunities	45	20.6
f) High taxes	3	0.5	f) High taxes	7	3.2
g) Other (specify)	97	17.4	g) Other (specify)	10	4.6
Total	557	100	Total	218	100

Source: Own computation based on RCC Survey 2021

3.7 Other Income Sources

As Table 3.27 shows, the main alternative sources of income for the households in the study area were wages/salaries (14 percent), remittances (11 percent), and land rental (6 percent). The average annual income from these sources was ETB 13,488, as shown in Table 3.29, with a median income of ETB 5,000.

Table 3.27: Other income sources

Other income sources	Freq.	%
Remittances	223	11.2
Wages/salaries	276	13.8
Pension	11	0.6
Shop/store/ house/rental/ car/truck etc.	72	3.6
Land rental	124	6.2
Renting horse cart	33	1.7

Source: Own computation based on RCC Survey 2021

Table 3.28 shows that more households in the Amhara region (230) received income from other sources, followed by the SNNPR (184), and Oromia (157) regions, with an average income of ETB 10,848, 10,124, and 12,170, respectively. However, households in the Somali region, followed by Dire Dawa, received the highest average income from other sources such as remittances. The average annual income from other sources was ETB 13,488. Table 3.29 shows that households in SLMP Woredas, followed by non-programme Woredas, received the highest average income from other sources.

Table 3.28: Average annual income from other income sources

Region	Mean	SD	No. of HHs reported
Amhara	10,848	47,978	230
Oromia	12,170	22,497	157
Somali	39,629	45,263	34
SNNPR	10,124	14,300	184
Gambela	18,752	26,302	59
Dire Dawa	21,277	16,919	30
Average	13,488	33,768	694

Source: Own computation based on RCC Survey 2021

Table 3.29: Annual average income from other sources by programme

Programme	Mean	SD	No. of HHs reported
AGP	2,440	7,536	400
PSNP	4,448	12,464	600
SLMP	5,981	33,476	550
Non-programme	5,391	18,729	450

Source: Own computation based on RCC Survey 2021

CHAPTER 4: WEALTH AND CONSUMPTION

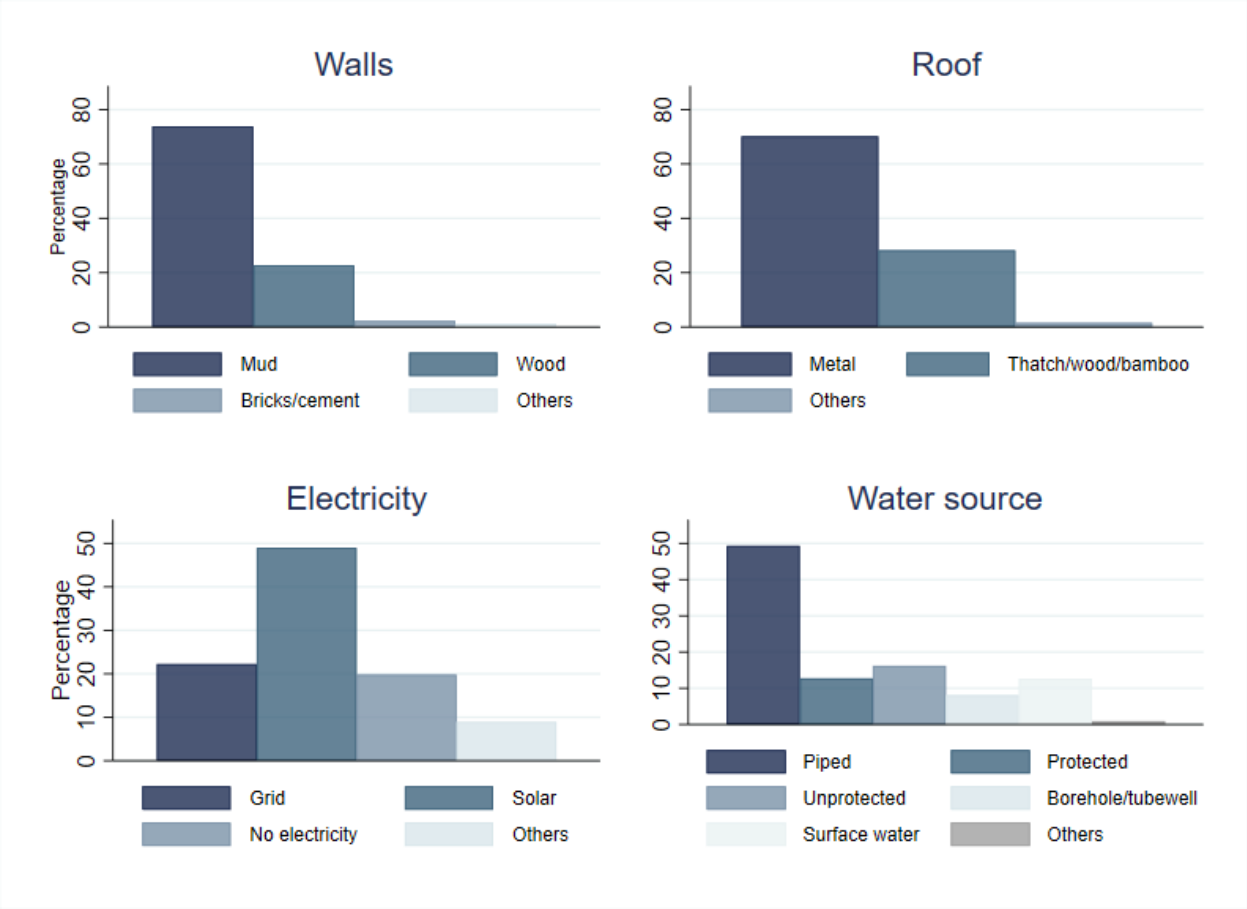
HIGHLIGHTS:

- Cereals/grains were the most consumed foods, followed by beverages and stimulants. Meat was the least consumed food group, followed by vegetables and fruits.
- The three most important non-food expenditure items were fees and contributions, clothing, and saving deposits.

4.1 Housing, Energy, Water Sources, and Toilet Facilities

Before turning to food and non-food expenditure, this sub-section describes measures of wealth. In the absence of detailed income and wealth data, the data contains a number of variables which measure household characteristics that can act as wealth indicators. Various aspects contribute to this, and while information on employment, education, and assets is given in other parts of the report, Figure 4.1. shows the mean values of four key housing variables: (1) wall type, (2) roof type, (3) access to electricity, and (4) main water source. The figure shows that around 75 percent of households in the sample lived in dwellings made of mud (adobe), while 20 percent had wooden walls. Roofs were typically made of metal (70 percent), while a smaller proportion were thatched (~25 percent). Access to electricity was generally widespread (80 percent had access) and mostly came from solar energy. While this is great for lighting and phone charging, it is likely to be insufficient to power a refrigerator. Only around 22 percent of the sample had access to the grid. Almost half of the sample had access to piped water, while around 40 percent got their water from unprotected sources.

Figure 4.1: Roofs, walls, electricity, and water source



Source: Own computation based on RCC Survey 2021

4.2 Consumption – Food Aggregates

In the nutritional sciences literature, there are several indicators that can be used to measure nutrition-based impacts (Babatunde and Qaim, 2010; Nguyen and Winters, 2011). This section defines dietary diversity as the number of different foods or food groups consumed over a given reference period (Ruel, 2002). This assumes that the more food items and groups or varieties of food that are included in the day-to-day diet, the greater is the likelihood of meeting essential nutrient requirements (Labadarios et al., 2011).

Dietary intake and diversity can be measured in a variety of ways. A dietary diversity[4] score is one of the most direct indicators of food and nutrition security (Gilligan and Hoddinott, 2007; Hoddinott and Skoufias, 2004). Therefore, we now calculate the Simpson index (SI) per adult equivalent nutrient intake of calories, protein, and iron. The SI of food diversity measures household access to a variety of foods. It is also a proxy for the nutritional adequacy of individual diets (Ruel, 2003). The SI is mathematically defined as a function of the household consumption share of each food item:

$$SI = 1 - \sum_{i=1}^{n} w_i^2 ,$$

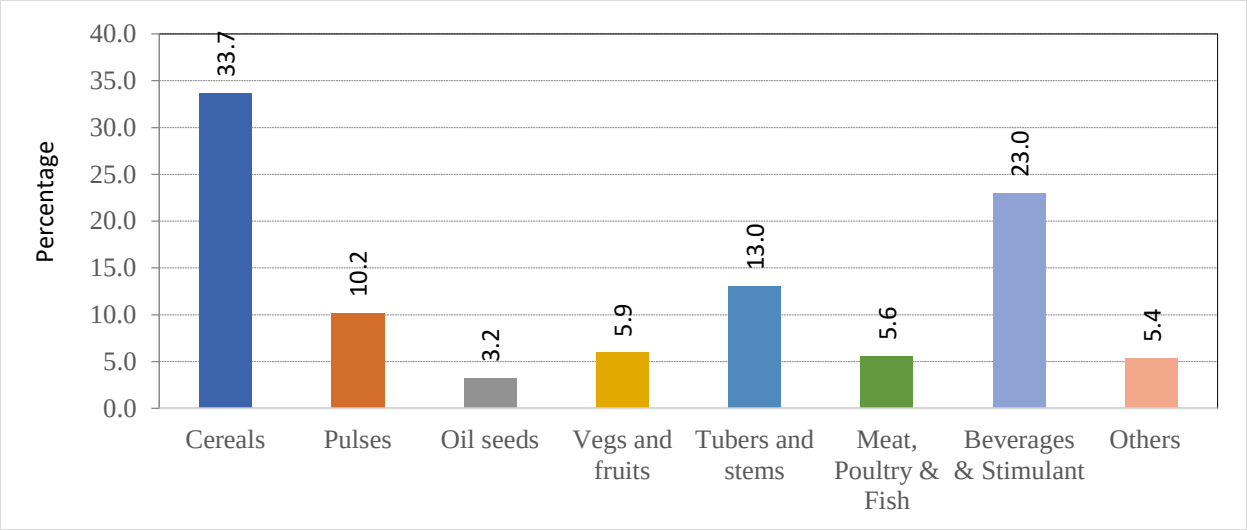
where w_i is the calorie share of the i^{th} food item.

The SI varies from zero to one, such that the higher the index, the more diversified the food. Total consumption was determined by summing the consumption levels collected for 51 food items and eight food groups, over seven days. The food items were grouped into eight categories: cereals; pulses; oilseeds; vegetables and fruits; tubers and stems; meat, poultry, and fish; beverages and stimulants; and others. The physical quantities of food consumed by a household were converted into calories, protein, and iron intake, adjusted for household age and sex composition using the national food composition table compiled by the Ethiopian Health and Nutrition Research Institute (EHNRI, 2000).

Before presenting the dietary diversity score results, we look at household consumption by food group. Figure 4.2 illustrates the distribution of food groups consumed as a percentage of food consumed. Cereals/grains (wheat, maize, teff, and sorghum) was the most commonly consumed food group (34 percent), followed by beverages and stimulants. Meat foods (meat, poultry, and fish) was the least consumed food group (5.6 percent), followed by vegetables and fruits (6 percent).

[4] Dietary diversity refers to nutrient adequacy, defined as a diet that meets the minimum requirements for energy and all essential nutrients. The rationale for using dietary diversity as an indicator for dietary quality stems primarily from a concern related to nutrient deficiency and recognition of the importance of increasing food and food group variety to ensure nutrient adequacy.

Figure 4.2: Consumption of proportion of food groups as a percentage of total diet (grams)



Source: Own computation based on RCC Survey 2021

Table 4.1 presents the percentage contribution of food groups in the quantity of total food consumption by region. Cereals (teff, wheat, maize, barely, and sorghum) contributed the most to household food consumption patterns in all regions except Somali and Dire Dawa. Pulses and beverages and stimulants had the highest share in the Somali region and Dire Dawa, at 29 percent and 46 percent, respectively. Unlike in other regions, tubers and stems made the second highest contribution to the quantity of food consumption in SNNPR , reflecting the dependence of the region's population on such food groups. The share of the quantity of flesh food consumption was lowest in Somali (3.7 percent) and Dire Dawa (1.7 percent) and highest in Gambela (11 percent).

Table 4.1: Consumption share of food groups, by region (percent)

Food group	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa
Cereals	35.3	34.3	28.0	32.2	39.3	34.2
Pulses	6.4	7.4	29.0	7.1	7.7	4.6
Oilseeds	2.7	4.2	0.0	3.9	6.0	3.3
Vegetables and fruits	4.6	5.2	6.0	8.2	12.6	2.6
Tubers and stems	16.9	17.7	7.4	26.8	10.3	4.7
Meat, poultry, and fish	9.5	6.0	3.7	5.2	11.1	1.7
Beverages and stimulants	22.3	21.4	13.4	8.7	8.9	46.3
Others	2.3	3.8	12.5	7.9	4.1	2.7

Source: Own computation based on RCC Survey 2021

Table 4.2 shows the average daily consumption of calories, protein, and iron and the degree of dietary diversity, measured by dietary diversity score. The average per adult calorie consumption for the sample households was about 2,827 kcal per day. This is higher than the

average daily per capita calorie requirement needed to maintain a healthy life. This is also higher than the national average calorie consumption of 1,950 kcal (FAO, 2010). However, 54.7 percent of the sample households consumed less than the 2,200 kcal required for healthy daily physiological requirements. The average protein consumption per day per adult was about 77 gm. This is higher than the national average dietary protein consumption of 57 gm per person per day. The average iron consumption per adult per day was about 17 mg. In terms of gender, female-headed households enjoyed relatively higher calorie, protein, and iron intake per day than their male-headed counterparts.

Based on the dietary diversity measured in the simple count of food groups that households consumed over the last seven days before the survey, the mean dietary diversity for all households was 5.9 (Table 4.2). This indicates that, on average, a household consumed almost six different food groups in the seven days preceding the survey, which indicates medium dietary diversity. The simple count measure (household dietary diversity score (HDDS)) shows that male-headed households had slightly greater dietary diversity than female-headed households (Table 4.2). However, this contrasts with Rogers (1996) and Taruvinga et al. (2013) who argued that female heads of households have a higher likelihood of attaining a high dietary diversity than their male counterparts.

Table 4.2: Household dietary intake and food diversity

	Full sample	Male	Female
Calorie intake per adult equivalent, kcal per day	2,827	2,822	2,850
Protein intake per adult equivalent, gm per day	8.0	76.8	77.6
Iron intake per adult equivalent, mg per day	16.7	16.5	17.4
HDDS	5.9	6.0	5.73
Number of observations	2,000	1,634	366

Source: Own computation based on RCC Survey 2021

Descriptive analyses of food consumption per capita and dietary diversity outcomes across regions show several important findings (Table 4.3). With regard to food consumption per capita, the Oromia, Somali, and Dire Dawa regions had higher food consumption per capita, while the lowest was observed in SNNPR. When we look at the dietary diversity measured using the SI, Gambela has the highest value for calorie and protein intake, while Somali has the highest for iron intake.

Table 4.3: Household-level dietary intake, by region

Region	Calorie intake per day (kcal)	Dietary indicators		HDDS	Simpson index		
		Protein intake per day (gm)	Iron intake per day (mg)		Calorie	Protein	Iron
Amhara	2,426	62.6	13.4	5.7	0.5	0.5	0.5
Oromia	4,459	130.1	24.3	6.4	0.6	0.5	0.5
Somali	3,855	117.3	23.7	6.0	0.6	0.5	0.6
SNNPR	1,667	42.0	12.2	5.5	0.6	0.6	0.5
Gambela	2,201	49.5	13.3	6.9	0.7	0.6	0.6
Dire Dawa	3,545	80.0	20.0	5.6	0.4	0.3	0.4
Total	2,827	77.0	16.7	5.9	0.6	0.5	0.5

Source: Own computation based on RCC Survey 2021

The FAO's classification of food consumption as consumption of fewer than three food groups, four to five food groups, and greater or equal to six food groups reflects poor, medium, and high dietary diversity, respectively (FAO, 2007). Based on this classification, we observe medium dietary diversity for Amhara, SNNP, and Dire Dawa and high dietary diversity for Gambela, Oromia, and Somali (Table 4.3). We also note that female-headed households enjoyed relatively higher levels of dietary intake (calorie, protein, and iron intake per day) in the Amhara, Oromia, Dire Dawa, and Somali regions than their male-headed counterparts (Table 4.4). In SNNPR and the Gambela region, male-headed households had relatively better calorie and protein intake than their female counterparts.

Table 4.4: Household-level dietary intake, by region and gender per day

	Calorie (kcal)			**Protein (gm)**			**Iron (mg)**		
Region	Male	Female	Total	Male	Female	Total	Male	Female	Total
Amhara	2,354	2,828	2,426	59	81	63	13	17	13
Oromia	4,427	4,620	4,459	130	131	130	24	25	24
Somali	3,748	4,342	3,855	114	131	117	24	24	24
SNNPR	1,683	1,609	1,667	43	40	42	12	12	12
Gambela	2,348	1,681	2,201	53	36	49	14	12	13
Dire Dawa	3,443	3,869	3,545	78	85	80	19	22	20
Total	2,822	2,850	2,827	77	78	77	17	17	17

Source: Own computation based on RCC Survey 2021

The SI values for calorie and protein consumption across regions further show that female-headed households had either the same or slightly higher dietary diversity than their male-headed counterparts. However, the SI for the full sample is generally the same for male-headed households and their female counterparts (Table 4.5).

Table 4.5: Household-level food diversity outcomes, by region and gender

Region	Simpson index								
	Calorie			**Protein**			**Iron**		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Amhara	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5
Oromia	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Somalia	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6
SNNPR	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
Gambela	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.4	0.6
Dire Dawa	0.4	0.5	0.4	0.3	0.4	0.3	0.4	0.4	0.4
Total	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5

Source: Own computation based on RCC Survey 2021

4.3 Expenditure on Non-food and Food Items

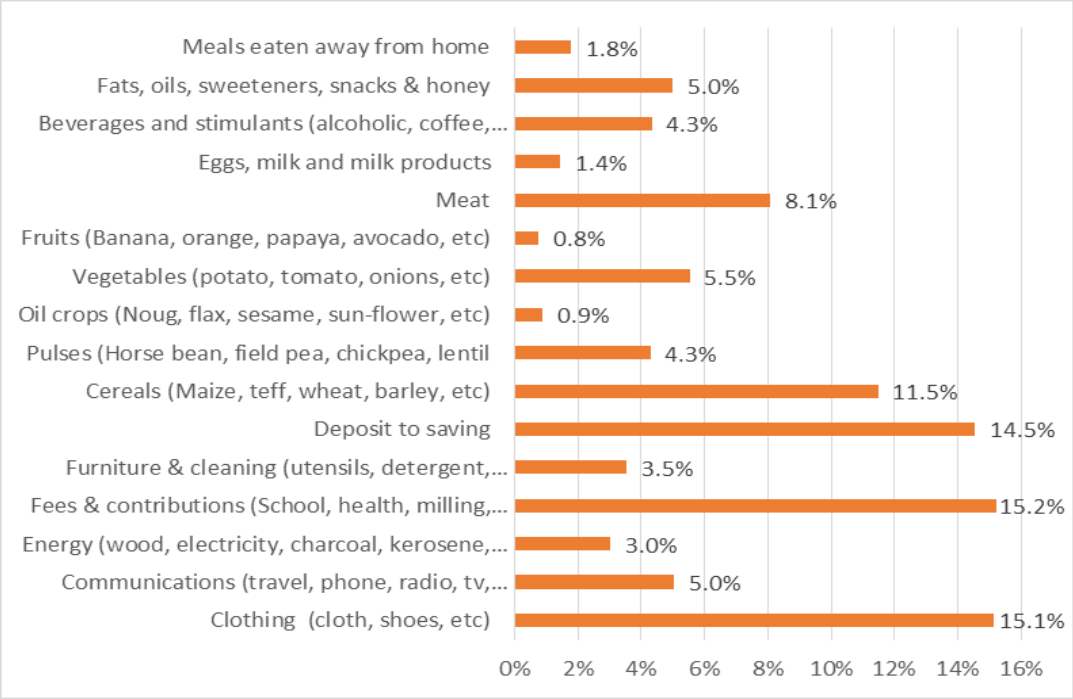
This section describes the expenditure of sample households on food and non-food items. Table 4.6 shows detailed expenditure on food and non-food items for each region covered. The first six on the list are non-food items while the rest are food items. In terms of the average expenditures for the full sample, the three most important are non-food expenditure items, namely, fees and contributions (ETB 3,748), clothing (ETB 3,733), and savings deposits (ETB 3,585). These are followed by cereals (ETB 2,831), a food item (Table 4.6).

Table 4.6: Expenditure on food and non-food items in ETB, by region per household

Food and non-food items	Amhara	Oromia	Somali	SNNPR	Gambela	Dire Dawa	Full sample
Clothing (cloth, shoes, etc.)	3,439	5,291	7,188	2,105	3,503	4,516	3,733
Communications (travel, phone, radio, tv, newspapers)	1,043	1,711	3,572	658	1,382	913	1,242
Energy (wood, electricity, charcoal, kerosene, batteries, etc.)	1,098	747	1,351	463	165	331	742
Fees and contributions (school, health, milling, tax, dowry, associations, funeral, remittance, rent, ceremony, debt)	3,419	4,324	17,599	1,653	2,354	3,356	3,748
Furniture and cleaning (utensils, detergent, repairs)	930	1,114	2,806	457	57	809	874
Saving deposits	4,830	4,670	13,884	656	1,110	400	3,585
Cereals (maize, teff, wheat, barley, etc.)	1,608	4,305	5,956	1,566	3,228	9,449	2,831
Pulses (horse beans, field peas, chickpeas, lentils)	1,551	1,530	55.6	403	1,383	208	1,055
Oil crops (noug, flax, sesame, sunflower, etc.)	76	383	551	39	618	708	215
Vegetables (potatoes, tomatoes, onions, etc.)	1,243	1,860	3,239	696	1,238	2,359	1,362
Fruits (bananas, oranges, papayas, avocados, etc.)	62	326	566	135	99	110	187
Meat	2,180	2,269	2,152	1,758	1,166	1,110	1,988
Eggs, milk, and milk products	45	410	2,711	206	37	882	352
Beverages and stimulants (alcohol, coffee, tea, etc.)	1,267	1,560	684	684	560	181	1,067
Fats, oils, sweeteners, snacks, and honey	1,288	1,678	3,162	556	763	1,317	1,225
Meals eaten away from home	332	711	745	284	359	110	437
Total	24,410	32,887	66,222	12,319	18,023	26,757	24,641

Source: Own computation based on RCC Survey 2021

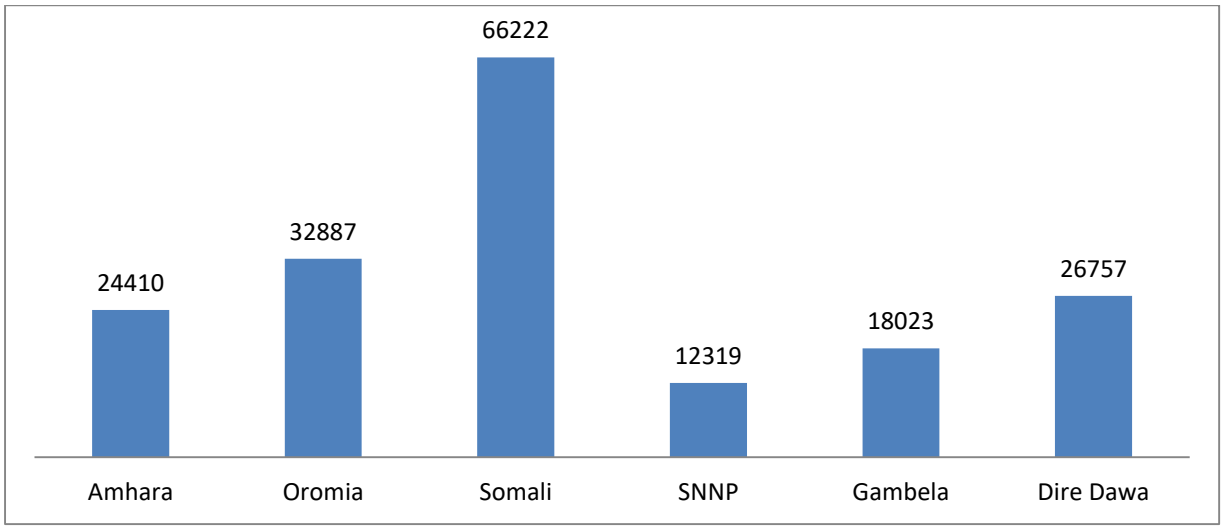
Figure 4.3: Percentage distribution of food and non-food expenditure items



Source: Own computation based on RCC Survey 2021

Regarding the percentage share of food and non-food expenditure, about 56 percent of total expenditure went on non-food items (Figure 4.3). The average (food and non-food) expenditure by region was largest for Somali (ETB 66,222), followed by Oromia (ETB 32,887), Dire Dawa (ETB 26,757), and Amhara (ETB 24,410) (Figure 4.4). This is similar to the results for food consumption.

Figure 4.4: Average food and non-food expenditure in ETB, by region



Source: Own computation based on RCC Survey 2021

Table 4.7: Descriptive statistics of per capita non-food and food expenditure

Variables	Obs.	Mean	SD	Min	Max
Non-food expenditure per capita	2,000	2,850	7,549	0	16,8783
Clothing	2,000	726	17.5	0	13,750
Communications	2,000	259	16.0	0	25,000
Energy	2,000	168	10.2	0	12,500
Fees and contributions	2,000	727	70.9	0	122,222
Furniture and cleaning	2,000	182	18.2	0	33,333
Deposit to saving	2,000	790	126.6	-9.6	166,667
Food expenditure per capita	2,000	2,215	2220.7	0	28,000
Cereal	2,000	571	22.0	0	14,400
Pulses	2,000	220	7.4	0	3,500
Oil crops	2,000	45	4.2	0	5,000
Vegetables	2,000	285	8.0	0	3,571
Fruits	2,000	37	2.0	0	1,040
Meat	2,000	415	12.1	0	6,000
Eggs, milk, and dairy	2,000	72	7.0	0	6,000
Beverages and stimulants	2,000	223	7.4	0	5,625
Fats, oils, sweeteners, snacks, and honey	2,000	253	7.6	0	5,000
Meals eaten away from home	2,000	95	7.7	0	8,000

Source: Own computation based on RCC Survey 2021

CHAPTER 5: DROUGHT, COPING STRATEGIES, AND RESILIENCE CAPACITIES

HIGHLIGHTS:

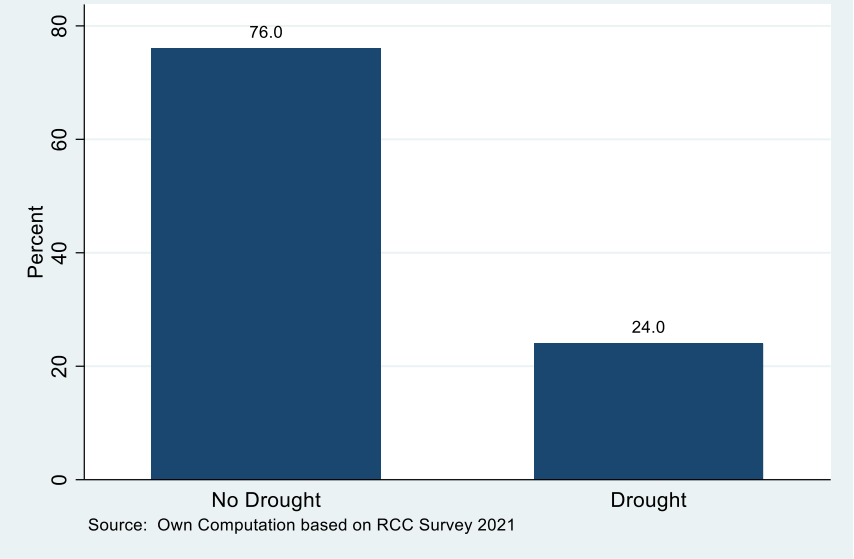
- In our survey, a quarter of the households had been exposed to a drought in the past five years.
- The dominant coping strategy was adjusting consumption followed by selling livestock.
- The majority of the households were pessimistic about the likelihood of recovering from drought damage within six months, indicating limited absorptive capacity.
- As the number of droughts faced increases, the self-reported likelihood of recovery decreases, and the likelihood of recovery also increases with household education level.
- A higher proportion of households believed they were unlikely to adapt to future drought-induced threats in all regions. However, most respondents were unlikely to change their primary source of income in the case of drought in the future.

5.1 Drought Exposure

This section presents descriptive statistics on drought exposure and intensity among households in the survey. We also assess the impact of drought in the past five years and the coping mechanisms households chose to adopt in the face of a drought shock. As part of this, we explore whether there are heterogeneities in the observed patterns based on gender and education level of the head of the household and across regions.

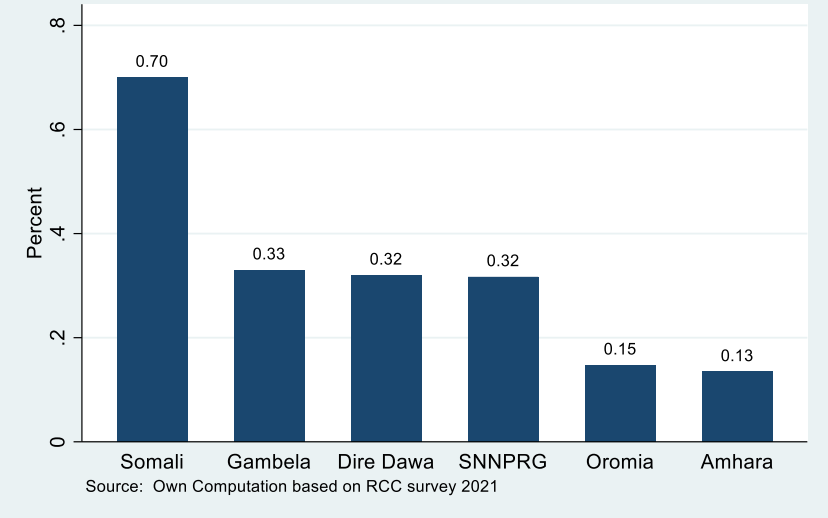
Figure 5.1 depicts the exposure to drought in the past five years. While 24 percent of rural households (480 out of 2,000) sampled in our survey had been exposed to at least one drought episode in the past five years, the vast majority in our sample, i.e. 76 percent (1,580 households), had not experienced any drought during this period.

Figure 5.1: Drought exposure in the past five years



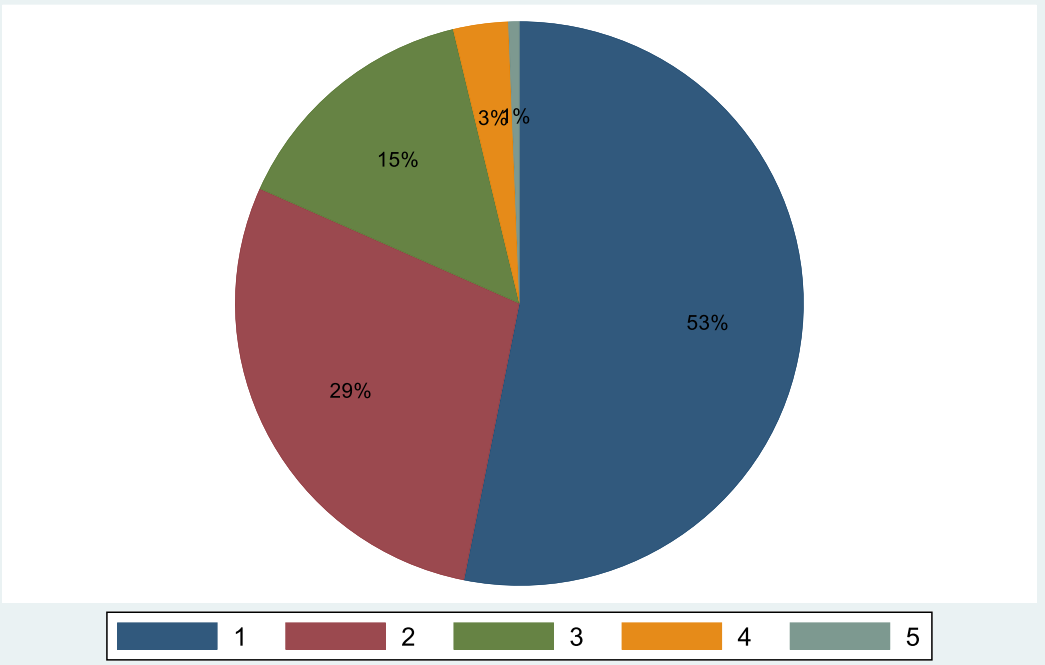
However, there is clear heterogeneity in drought exposure among the different regions. As Figure 5.2 shows, the highest drought exposure in the past five years was reported for households in the Somali region. Of the 100 households sampled from the Somali region, 70 percent (70 households) responded that they had experienced at least one drought during the past five years. However, the percentage share of households that reported drought in Gambela, Dire Dawa, and SNNPR appears to be similar, at slightly above 30 percent. In the case of SNNPR, the observed share is smaller despite the large number of households sampled from the region (650 households). For the Oromia and Amhara regions, out of the 550 households sampled from each region, the percentage share of drought-exposed households is 15 and 13 percent, respectively.

Figure 5.2: Drought exposure in the past five years, by region



When we look at the frequency of droughts, as shown in Figure 5.3, 53 percent of households in the sample had experienced drought only once over the five years, 29 percent had faced drought twice, and 19 percent had experienced three to five droughts.

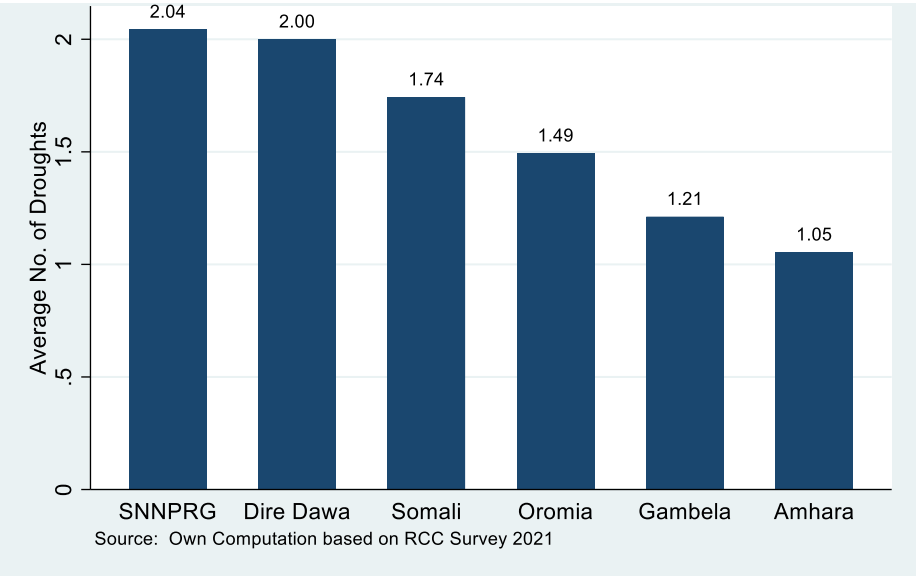
Figure 5.3: Number of droughts in the past five years



Source: Own Computation based on RCC Survey 2021

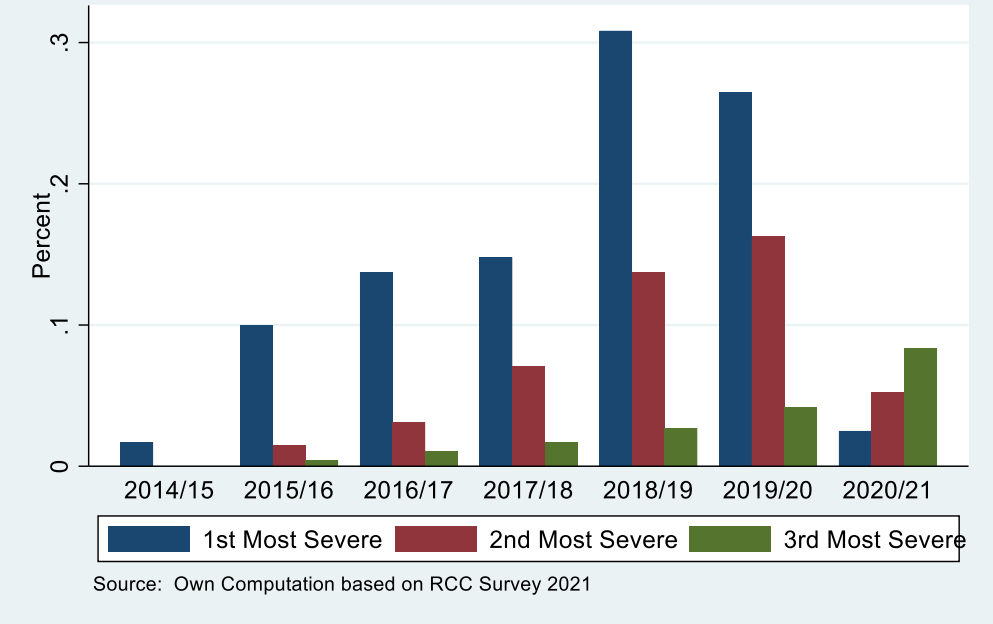
Disaggregating the frequency of droughts by region, as depicted in Figure 5.4, households in SNNPR and Dire Dawa reported the highest number of droughts, followed by Oromia, Gambela, and Amhara. In particular, in SNNPR and Dire Dawa, the average number of droughts reported by households was twice that reported by households in the Amhara region.

Figure 5.4: Average number of droughts, by region



In the survey, households were asked to list the three most severe droughts they had faced during the past five years, in order of severity. The responses to these questions are summarized in Figure 5.5. As can be seen, more than 30 percent of households in the sample reported 2018/19 as the year when they had experienced the most severe drought. This is followed by 2019/20, which more than 25 percent of households reported as being the most severe drought year. Most households also reported these two years (2018/19 and 2019/20) as the years when the second most severe drought had occurred (see Figure 5.5). These responses are somewhat contrary to expectations as the El-Niño-induced drought which occurred in 2015/16 is one of the most severe droughts in Ethiopia's history. Despite this, only a small proportion of households indicated that 2015/16 had been the most severe drought year.

Figure 5.5: Drought severity, by year



Moving to the impact of drought over the past five years, we report summary statistics in Table 5.1. Among drought-exposed households in the sample, a higher proportion (78 percent) reported crop loss as the major impact of the drought/s they had faced over the past five years. Moreover, 16 percent of households reported having experienced livestock deaths because of the drought/s that had occurred in the past five years.

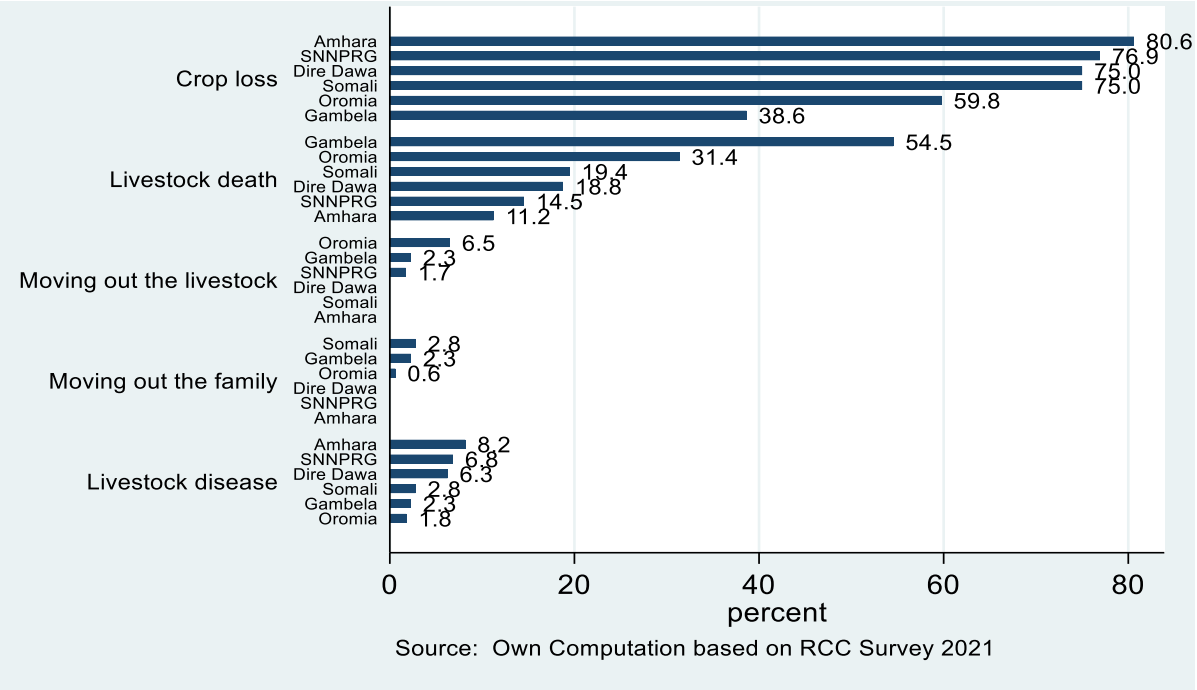
Table 5.1: Summary statistics on the impact of drought in the past five years

	Obs.	Mean	SD	Min	Max
Crop loss	437	0.8	0.4	0.0	1.0
Livestock death	437	0.2	0.4	0.0	1.0
Moving out livestock	437	0.0	0.1	0.0	1.0
Moving out family	437	0.0	0.1	0.0	1.0
Livestock disease	437	0.1	0.2	0.0	1.0

Source: Own computation based on RCC Survey 2021

In Figure 5.6, we explore regional heterogeneity in the impact of drought shocks during the past five years. In the case of crop loss, while all regions had been affected by drought-induced crop loss in the past five years, Amhara and SNNPR were the most affected regions, where 81 percent and 77 percent of households, respectively, reported crop loss due to drought. This is followed by Dire Dawa, Somali, and Oromia, where 75, 75, and 60 percent of drought-affected households reported crop loss following a drought shock. Households in the Gambela region were less affected by drought-induced crop loss. On the other hand, households in the Gambela region were the most affected, with about 55 percent of households reporting drought-induced livestock deaths. In addition, households in Oromia, Somali, and Dire Dawa also experienced drought-induced livestock deaths with respective shares of 31, 19, and 19 percent. Unlike in the case of crop loss, the Amhara and SNNPR regions were the least affected by drought-induced livestock death.

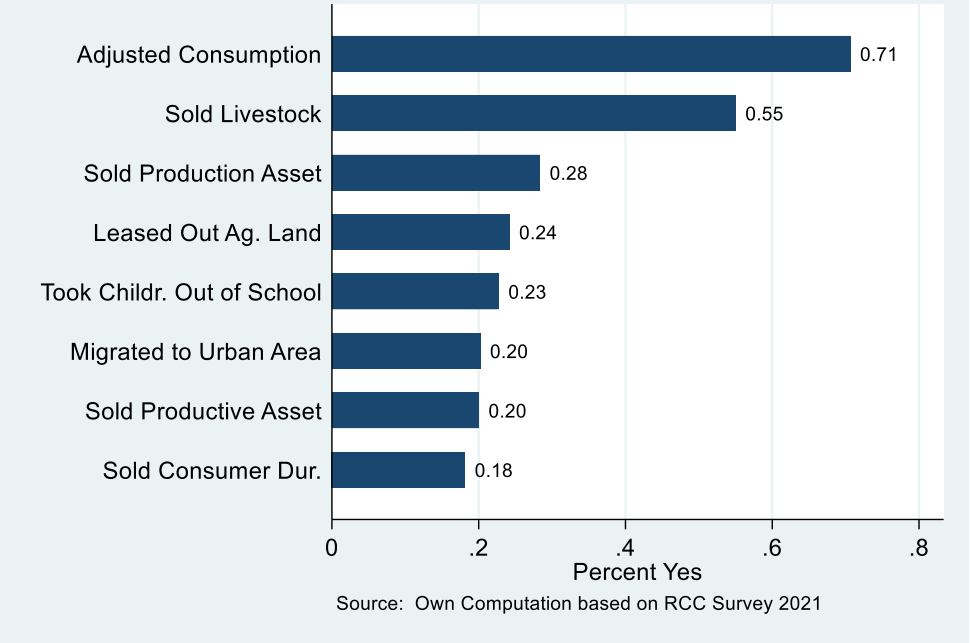
Figure 5.6: Drought impact in the past five years, by region



5.2 Coping Strategies

Liquidity constraints and limited access to formal credit are specific features of rural livelihoods. Under these circumstances, rural households use different coping strategies to minimize the immediate impact of an adverse shock and hence ensure intertemporal consumption smoothing. This section assesses the coping strategies that the drought-affected households in our sample adopted to mitigate the impact of drought shocks.

Figure 5.7: Coping strategies during drought



Source: Own Computation based on RCC Survey 2021

As depicted in Figure 5.7, consumption adjustment was the dominant coping strategy in the face of a drought shock, followed by selling livestock. In particular, 71 percent and 55 percent of drought-affected households in the sample reported consumption adjustment and the selling of livestock as their main coping strategies in the face of a drought shock.

In Table 5.2, we present a mean comparison of coping strategies disaggregated by gender of the household head to identify any differences between male-headed and female-headed households. We can see that the difference in the choice of coping strategies among female-headed and male-headed households is statistically indistinguishable from zero.

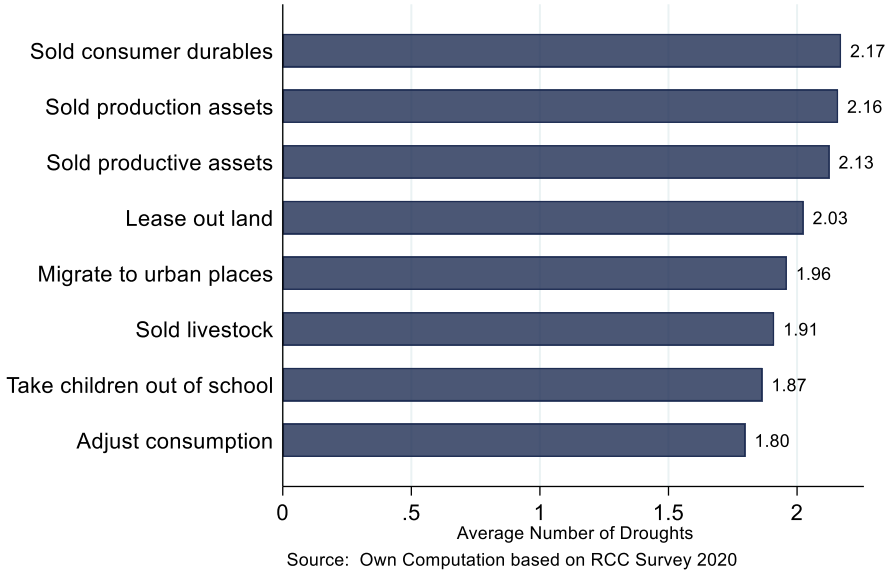
Table 5.2: Mean comparison of coping strategies, by gender of the household head

	Male	Obs.	Female	Obs.	Difference	p-val
Sold livestock	0.56	384	0.52	96	0.04	0.525
Sold production asset	0.29	384	0.26	96	0.03	0.572
Adjusted consumption	0.70	384	0.74	96	-0.04	0.413
Leased out ag. land	0.25	384	0.21	96	0.04	0.379
Took children out of school	0.23	384	0.20	96	0.04	0.432
Migrated to urban area	0.21	384	0.17	96	0.04	0.311
Sold consumer durables	0.18	384	0.20	96	-0.02	0.646
Sold productive assets	0.21	384	0.18	96	0.03	0.519

Source: Own computation based on RCC Survey 2021

In Figure 5.8, we plot the different types of coping strategies by the average number of droughts to see whether the choice of a specific coping strategy was influenced by the number of times a household experienced a drought shock.

Figure 5.8: Coping strategies, by number of droughts



Households which reported selling consumer durables, production assets, and productive assets and which had leased out land appear to have experienced a relatively higher number of droughts over the past five years. While these households reported having faced an average drought frequency of slightly above two, households which reported having used the other coping strategies had an average drought frequency of below two.

In Table 5.3, we assess the differences in the choice of coping strategy among households with and without farm income. In our sample, out of the 480 households that had faced at least one drought episode in the past five years, 141 reported having income from non-farm activities, and 339 were engaged in farm activities only. Although we expect households

with non-farm income sources to avoid damaging coping strategies like selling livestock and other productive assets, the results presented in Table 5.3 show the contrary. In particular, households with non-farm income appear to have used adverse coping strategies in the face of a drought shock relative to households with farm income only. This difference is statistically significant in all cases, except for consumption adjustment. One possible explanation for this is that households engaged in non-farm activities are relatively better off and likely to have more productive assets that they can use as a buffer stock in the face of a drought shock.

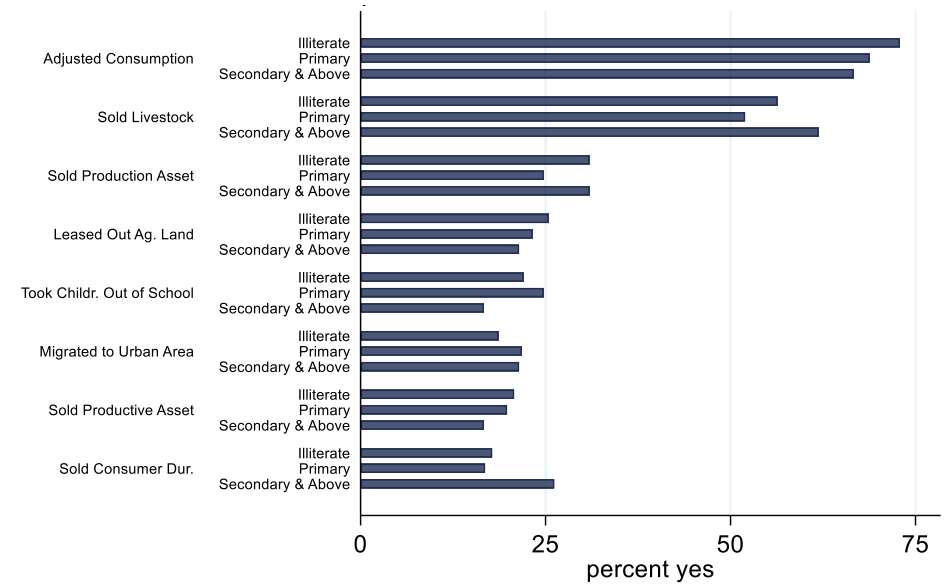
Table 5.3: Mean comparison of coping strategies, by non-farm activities

	Farm income only	Obs.	Non-farm income	Obs.	Difference	p-val
Sold livestock	0.52	339	0.63	141	-0.11**	0.020
Sold production asset	0.24	339	0.39	141	-0.15***	0.002
Adjusted consumption	0.70	339	0.73	141	-0.03	0.447
Leased out ag. land	0.21	339	0.31	141	-0.10**	0.028
Took children out of school	0.20	339	0.29	141	-0.09**	0.042
Migrated to urban area	0.18	339	0.26	141	-0.09**	0.046
Sold consumer durables	0.14	339	0.27	141	-0.12***	0.003
Sold productive assets	0.16	339	0.30	141	-0.15***	0.001

Source: Own computation based on RCC Survey 2021

Finally, in Figure 5.9, we plot coping strategies together with the level of education of the household head. Focusing on the dominant coping strategies in our sample, households whose heads had secondary-level education and above had a higher probability of selling livestock and production assets than households where the household head was illiterate and only had primary education. This is contrary to expectation as higher education is likely to be associated with higher income, reducing the probability of using adverse coping strategies. One likely explanation for this is that households with better-educated heads are likely to be better off and use livestock as a buffer stock. On the other hand, households with relatively more-educated heads are more likely to smooth consumption. In contrast, households with less-educated heads are more likely to adjust consumption in the face of a drought shock (see Figure 5.9).

Figure 5.9: Coping strategies in the face of drought, by education level of household head



Source: Own Computation based on RCC Survey 2021

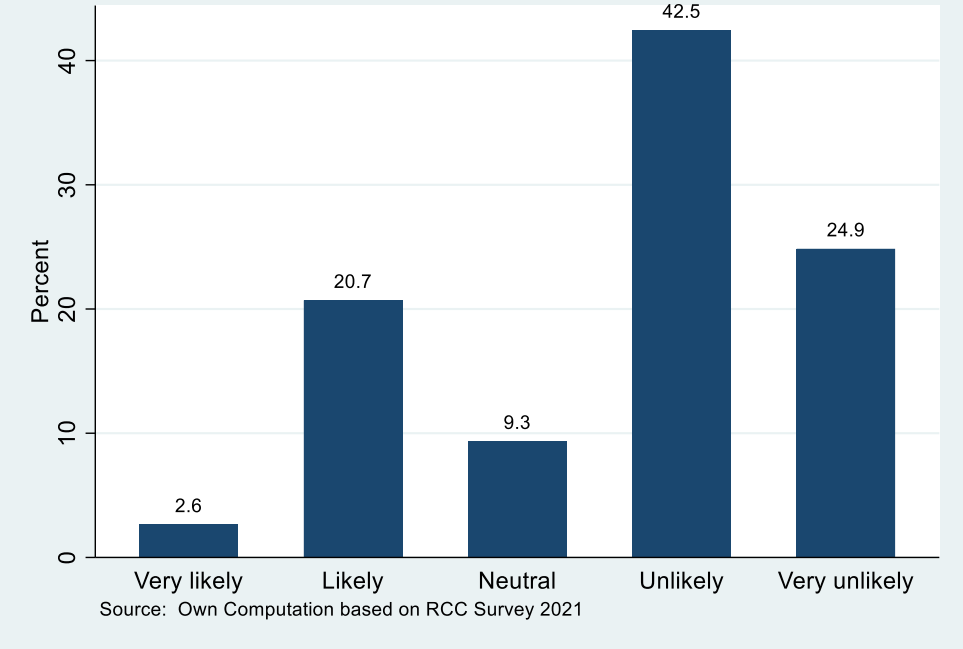
5.3 Resilience in the Face of Drought

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 different socio-economic capacities. This is in line 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 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.

5.3.1 Resilience Capacity: Absorptive

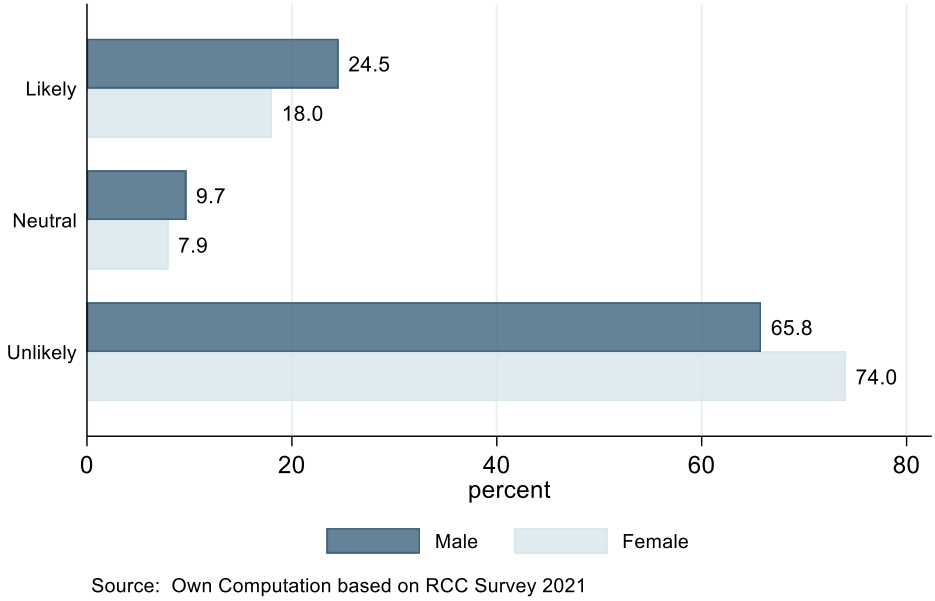
Absorptive capacity refers to short-term coping capacity, i.e. the capacity of households to reduce the immediate impact of an adverse shock on their livelihood. Respondents were asked how likely their household was to bounce back from a drought shock within six months. The responses to this question are summarized in Figure 5.10. Out of the total sample, while about 23 percent of respondents reported that they were likely to recover from drought damage in six months, the vast majority (67 percent) were less optimistic about their ability to recover in six months. This shows that the majority of households in our sample were less likely to be able to reduce the immediate impact of a drought shock on their livelihood, which is an indication of limited absorptive capacity.

Figure 5.10: Likelihood of recovering from drought damage within six months



In Figure 5.11, we assess whether there was a difference in the perception of absorptive capacity by gender of the household head. Although a high proportion of both female-headed and male-headed households reported that they were unlikely to recover from drought damage within six months, female-headed households were relatively more pessimistic about their capacity to manage the immediate impact of drought on their livelihood. The opposite is true when we look at the 'Likely' responses – a higher proportion of male-headed households reported that they were likely to recover from drought-induced damage within six months.

Figure 5.11: Likelihood of recovering from drought damage within six months, by gender



In Figure 5.12, we depict whether households' perceptions of the likelihood of recovering from a future drought shock vary with the number of droughts households faced in the past five years. Here we can offer two opposing explanations. One is the learning effect, i.e. as the number of droughts increases, households may adjust their livelihoods by learning from past droughts, which may increase their resilience to future droughts. On the other hand, repeated exposure to drought may have a severe effect on their livelihoods, making households less resilient to future drought shocks. As can be seen from Figure 5.12, the latter effect seems to dominate in our sample. In particular, as the number of droughts that households faced increases (decreases), the proportion of households which responded that they were unlikely (likely) to recover from drought damage within six months increases (decreases).

Figure 5.12: Likelihood of recovering from drought damage within six months, by number of droughts

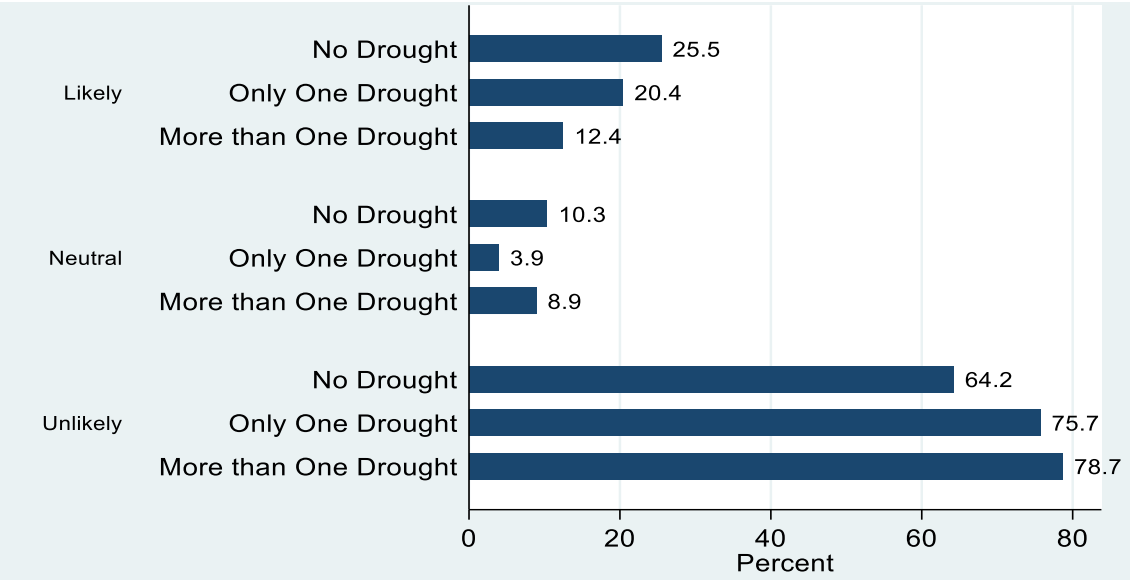
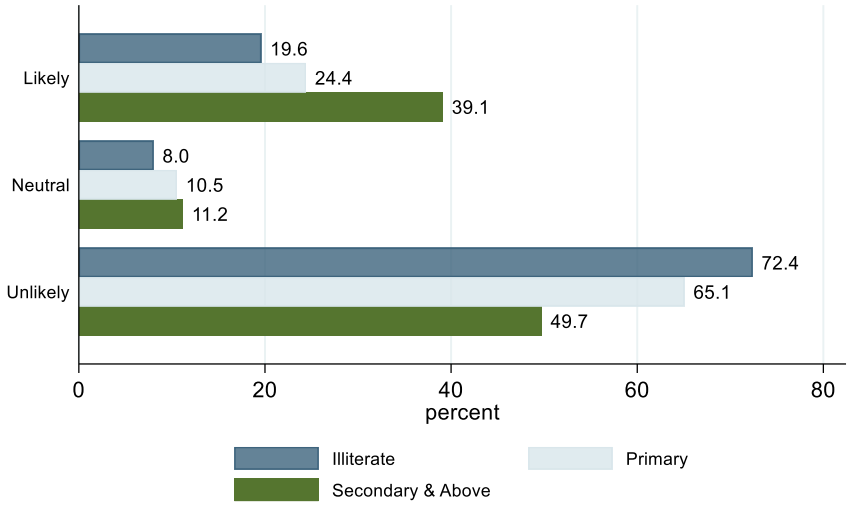


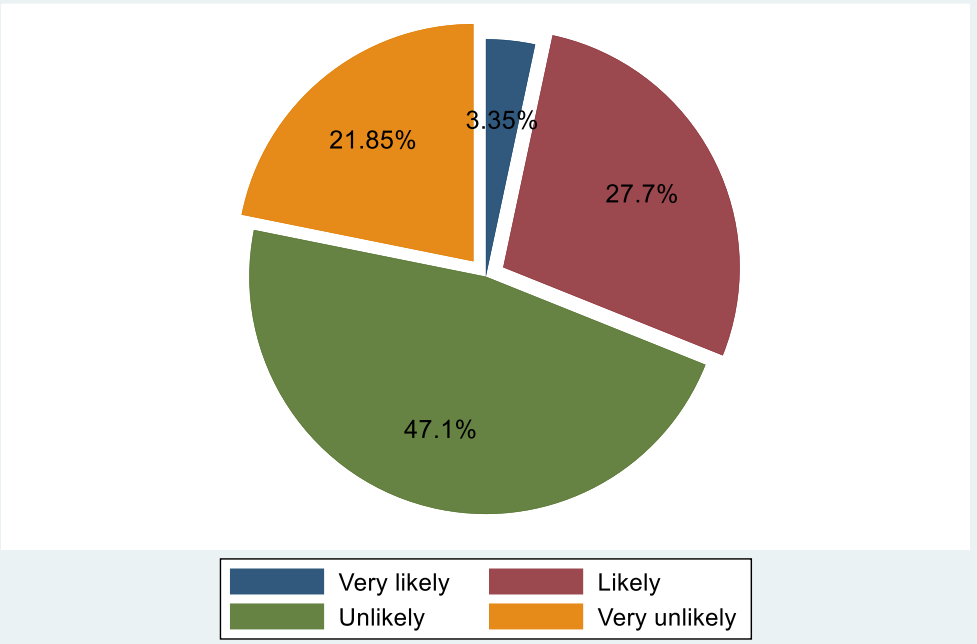
Figure 5.13: Recovering from drought damage within six months, by education level of household head



Source: Own Computation based on RCC Survey 2021

Finally, we investigate whether there is a differential pattern in households' perceptions of absorptive capacity according to the education level of the household head. As is apparent from Figure 5.13, households' perceptions of their likelihood of recovering from future drought damage increases (decreases) as the education level of the household head increases (decreases). Relaxing the liquidity constraint of rural households is likely to improve their capacity to mitigate the adverse impact of a drought shock in the short term. Support from family and friends, access to formal credit, borrowing from others, and availability of savings are the main components of absorptive capacity. They are likely to ease the short- to medium-term financial needs of households, especially in the face of an adverse shock. In what follows, we present descriptive statistics of these 'pillars of absorptive capacity'.

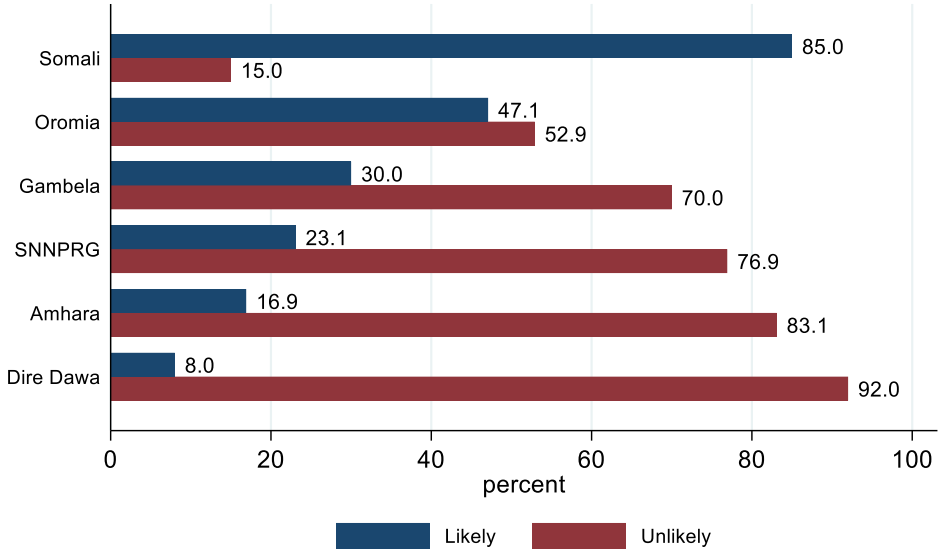
Figure 5.14: Relying on family and friends during drought



Source: Own Computation based on RCC Survey 2021

One of the pillars of absorptive capacity is social networks. Respondents were asked about their perception of the likelihood of relying on the support of family and friends to reduce the immediate impact of a drought shock. The responses to this question are summarized in the pie chart in Figure 5.14. We can see that a higher proportion of households in the sample (about 69 percent) believed that they were unlikely to rely on support from family and friends to mitigate the immediate impact of a drought. However, there is a clear difference across regions, as Figure 5.15 shows. In particular, 85 percent of the total households sampled from the Somali region responded that they were more likely to rely on support from family and friends to mitigate the adverse impact of a drought shock. Households in the Oromia and Gambela regions were also optimistic about support from their social networks, with 47 percent and 30 percent of households, respectively, reporting that they were more likely to rely on their social networks in the face of a drought shock.

Figure 5.15: Relying on family and friends during drought, by region

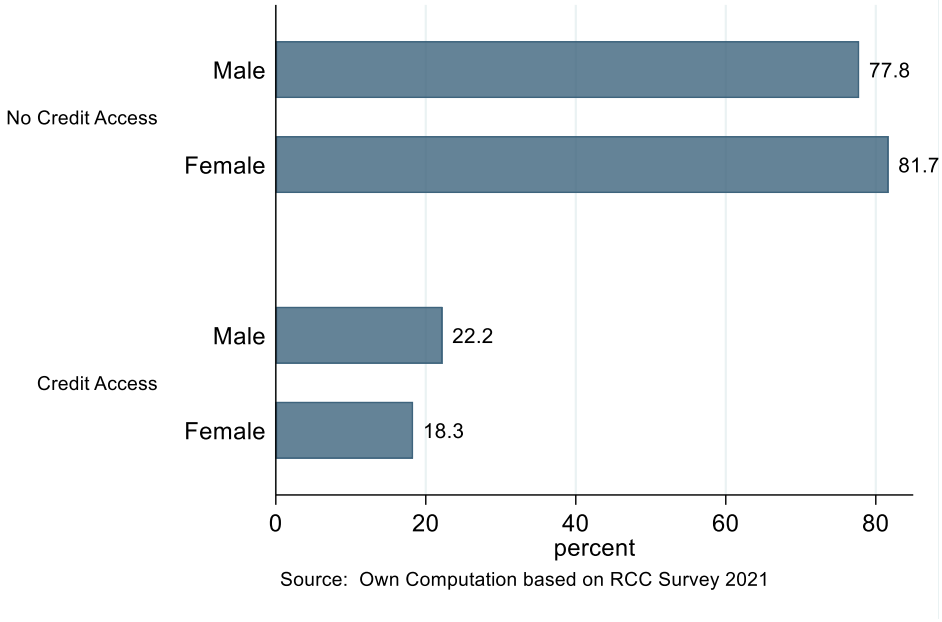


Source: Own Computation based on RCC Survey 2021

On the other hand, 92 percent of the total sample of households in the Dire Dawa region reported that they were unlikely to get support from family and friends to minimize the immediate impact of a drought shock. A larger proportion of households in the Amhara, SNNPR, and Gambela regions also reported that they were less likely to rely on social networks in the face of a drought shock. (See Figure 5.15.)

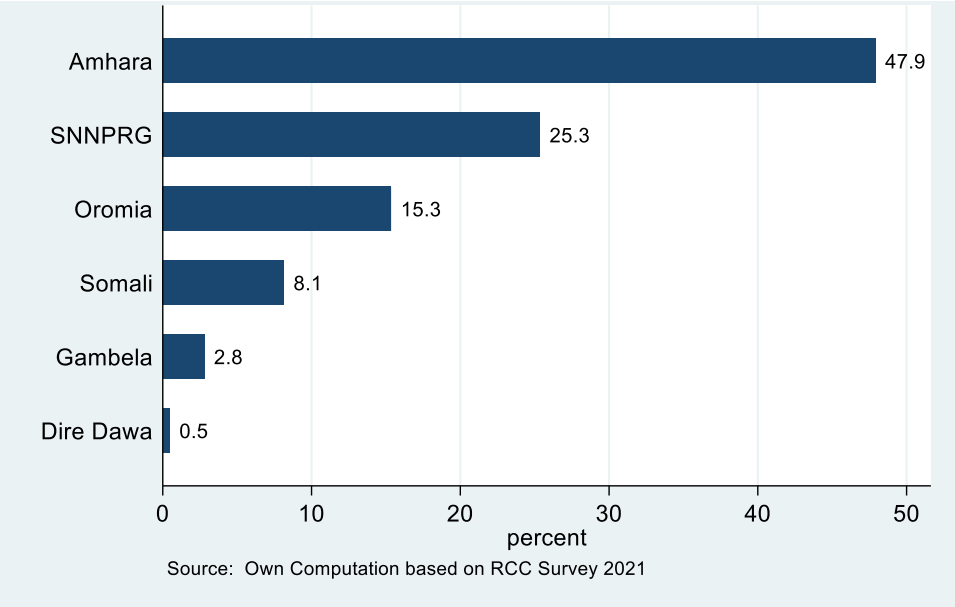
The second pillar of absorptive capacity is access to formal credit. Households in the survey were asked whether they had access to formal credit when facing a drought shock. Figure 5.16 shows that a high proportion of male- and female-headed households reported that they did not have access to formal credit the last time they faced an adverse shock. However, the proportion is slightly higher for female-headed households relative to male-headed households.

Figure 5.16: Access to formal credit in the face of a shock, by gender



The responses regarding access to formal credit vary by region, as can be seen from Figure 5.17. In particular, a higher proportion of households in the Amhara region (about 48 percent) reported having a lack of access to formal credit in the face of an adverse shock. This is followed by SNNPR and Oromia, where 25 and 15 percent of households, respectively, reported that they did not have access to formal credit last time they faced a shock.

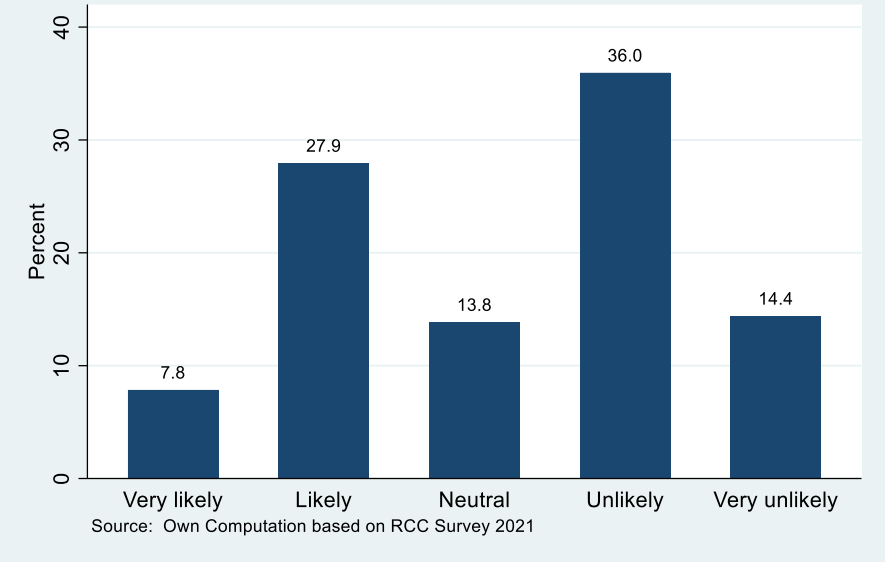
Figure 5.17: Access to formal credit in the face of a shock, by region



Another pillar of absorptive capacity is borrowing, and respondents were asked whether they could borrow from others when the household faced adverse shocks. As we can see from

Figure 5.18, around 50 percent of the total sample of households in the survey reported that they were unlikely to borrow from others in the face of a drought shock.

Figure 5.18: Likelihood to borrow from others in the face of a drought shock



Furthermore, as Figure 5.19 shows, female-headed households were less likely to borrow from others in the face of adverse shocks compared to their male counterparts.

Figure 5.19: Likelihood to borrow from others, by gender

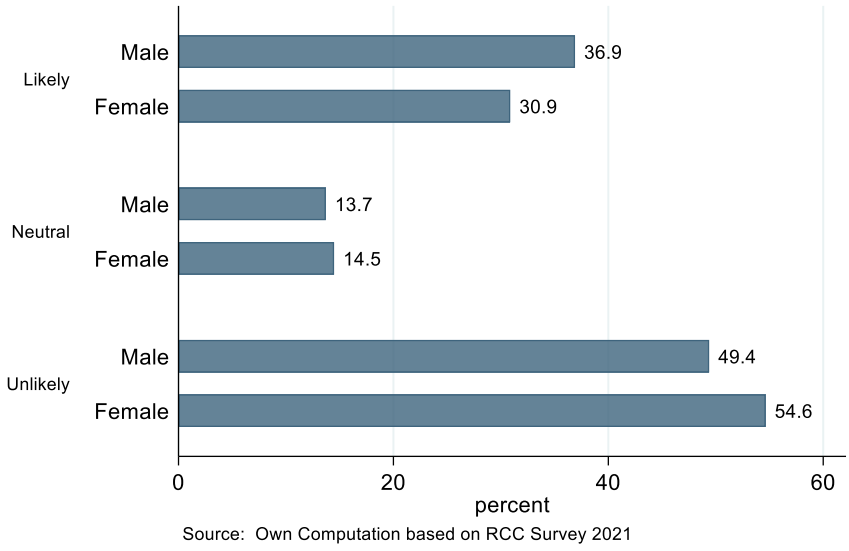


Table 5.4: Mean comparison of pillars of resilience, by gender of household head

	Male	Obs.	Female	Obs.	Difference	p-val
Rely on family and friends	0.31	1,634	0.30	366	0.01	0.647
No. of close social network	1.60	1,634	1.33	366	0.28	0.129
No. of distant social network	1.91	1,634	1.00	366	0.91**	0.033
Access to formal credit	0.22	1,634	0.18	366	0.04*	0.086
Can borrow ETB 500	0.65	1,634	0.49	366	0.16***	0.000
Saved enough to cope with drought	0.16	1,634	0.11	366	0.05***	0.009
Saving in the last 12 months	0.38	1,634	0.28	366	0.10***	0.000

Source: Own computation based on RCC survey 2021

Finally, in Table 5.4, we present a mean comparison of pillars of resilience across gender groups. With the exception of relying on social networks and the number of close social networks, female-headed households appear to have a significantly lower number of distant social networks and lower access to formal credit, are less likely to be able to borrow ETB 500 (if they want to) and are less likely to save enough (Table 5.4). This is likely to contribute to gender differences in resilience capacities.

5.3.2 Resilience Capacity: Adaptive

Another aspect of resilience is adaptive capacity, which refers to the long-term capacity of households to take incremental adjustment by learning from previous shocks. Unlike short-term coping capacity, long-term adaptive capacity constitutes an important component of resilience, as it is likely to contribute to household resilience more sustainably. In order to assess households' perceptions of adaptive capacity, respondents in the survey were asked how likely their household was to be able to adapt to drought-induced threats if the intensity and frequency of drought shocks were to increase in the future. The responses, disaggregated by region, are summarized in Table 5.5. A higher proportion of households believed that they were unlikely to adapt to future drought-induced threats in all regions. This was particularly the case in regions like Dire Dawa and Amhara, where more than 85 percent of the households responded that they were unlikely to adapt if the frequency and intensity of future drought shock increased. Somali and SNNPR follow this, where 79 of the households in these regions indicated that they were unlikely to adapt to drought-induced threats.

Table 5.5: Likelihood to adapt to drought-induced threats, by region

	Likely to adapt	Neutral	Unlikely to adapt
Amhara	10.0	5.3	84.8
Oromia	24.9	23.5	51.6
Somali	43.0	14.0	43.0
SNNPR	12.2	8.8	79.1
Gambela	14.0	7.0	79.0
Dire Dawa	8.0	6.0	86.0

Source: Own Computation based on RCC Survey 2021

In Table 5.6, we show if the likelihood of adapting to drought-induced threats varieds by programme participation and engagement in the non-farm activity. Programme non-participants in all cases seem to be more optimistic about their ability to adapt to future drought shocks. However, at this stage, one cannot say much about the impact of the specific programme on households' perception about adaptive capacity, as programme non-participants are likely to be systematically different from participants and this matters for households' perception of their adaptive capacity. For instance, in the case of PSNP, non-participants are likely to be better off and hence are likely to be more optimistic about their capacity to adapt to drought-induced threats.

Table 5.6: Likelihood to adapt to drought-induced threats, by programme participation

	Likely to adapt	Neutral	Unlikely to adapt
PSNP non-participant	17.9	12.7	69.4
PSNP participant	12.4	9.5	78.1
SLMP non-participant	15.5	11.8	72.7
SLMP participant	14.5	10.7	74.8
AGP non-participant	15.2	11.7	73.0
AGP participant	13.2	8.8	77.9
HH w/o non-farm income	16.6	12.4	71.0
HH with non-farm income	16.7	10.8	72.5

Source: Own computation based on RCC Survey 2021

In Table 5.7, we assess if the households' perception about adaptive capacity varies with the gender and education level of the household head. Even if a higher proportion of both female and male-headed households responded that they were unlikely to adapt to future drought-induced threats, female-headed households had a more pessimistic perception about their adaptive capacity in the face of a drought shock.

Table 5.7: Likelihood to adapt to drought-induced threats, by gender and household head education

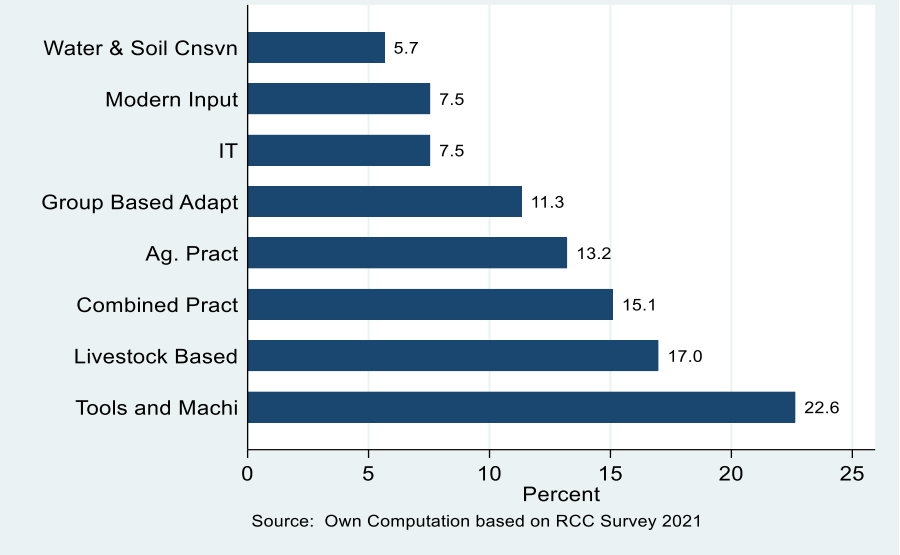
	Likely to adapt	Neutral	Unlikely to adapt
Male	17.6	11.8	70.6
Female	12.0	12.6	75.4
Illiterate	12.9	12.5	74.6
Primary	17.6	11.5	70.9
Secondary and above	32.4	11.2	56.4
Total	16.6	12.0	71.5

Source: Own computation based on RCC Survey 2021

Households' perception of adaptive capacity also varies with the education level of the head. In particular, the likelihood to adapt to future drought-induced threats increases with the level of education of the household head. As seen in Table 5.7, among households with household head education level of secondary and above, 32.4 percent reported that they were likely to adapt to future drought shocks. On the other hand, among households with illiterate household heads and where the head had only a primary level of education, only 13 and 18 percent responded that they were likely to adapt to future drought-induced threats.

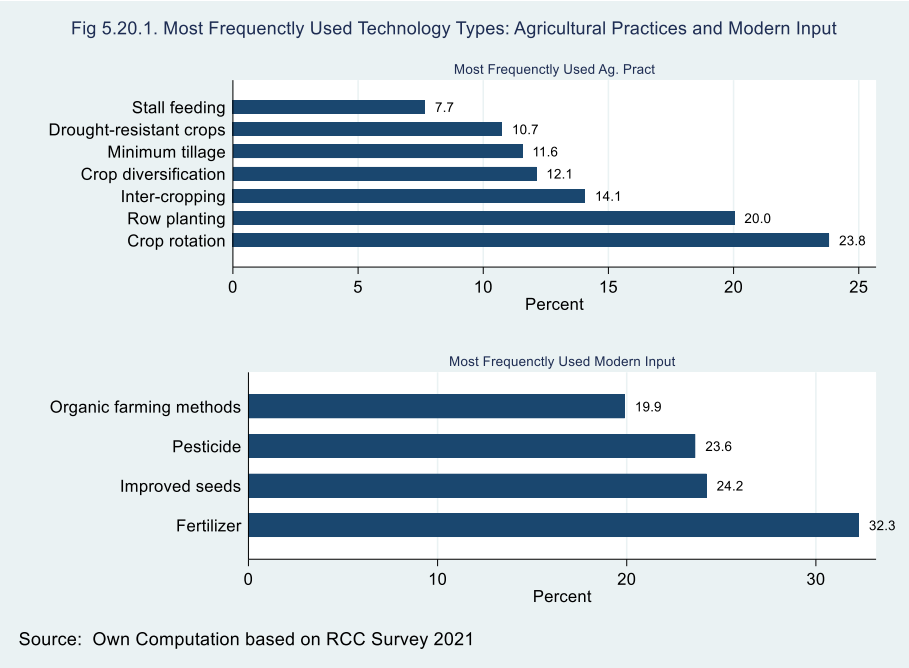
A number of factors contribute to improving the adaptive capacities of households in the face of a drought shock. These include investing in livelihood-enhancing activities and using modern agricultural technologies. With regard to the latter, households in the survey were asked about the type of agricultural technologies they had been using in the past five years or technologies they were currently using. As Figure 5.20 shows, while the extent varies, households in the sample used different types of agricultural technologies, including water and soil conservation, modern input, information technology, group-based adaptation, modern agricultural practice, livestock-based adaptation, tools, and machinery.

Figure 5.20: Most frequently used agricultural technology



Below, we further disaggregate each technology type to see which component within each group was the most frequently used. Figure 5.21 shows the most frequently used agricultural practices and modern inputs by the households in our sample. As the figure shows, the three most frequently used agricultural practices reported were crop rotation, row planting, and intercropping, respectively accounting for 24, 20, and 14 percent of the responses in our sample. On the other hand, other agricultural practices like crop diversification, minimum tillage, and drought-resistant crops were limited.

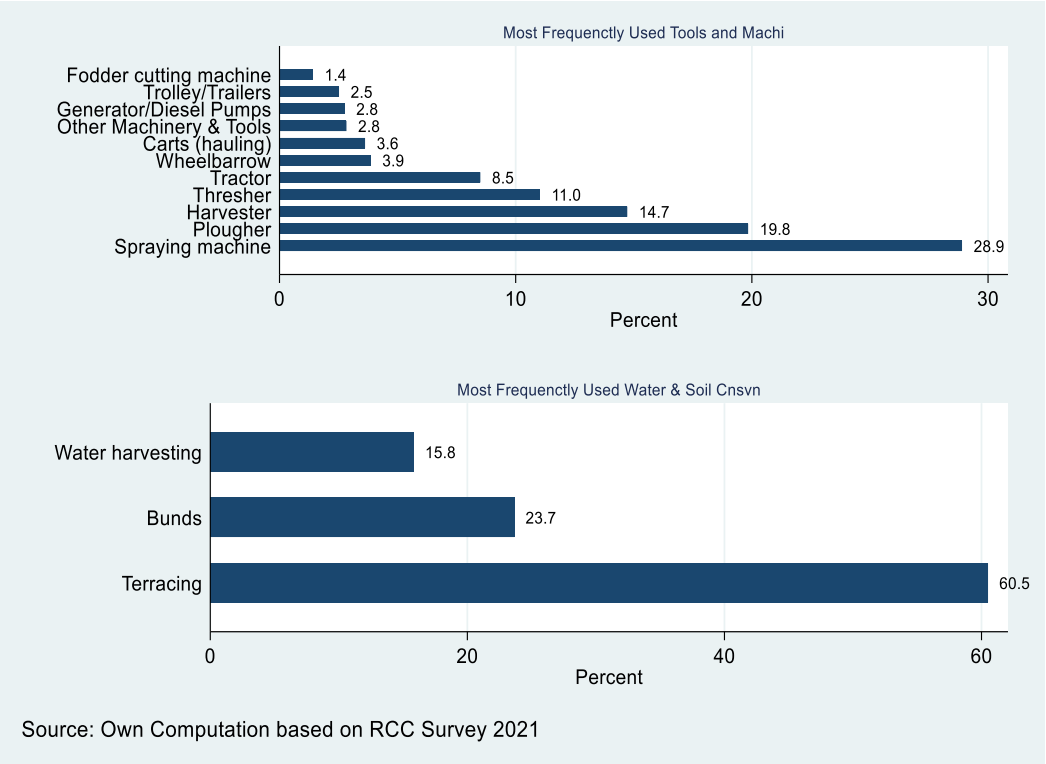
Figure 5.21: Most frequently used technology types: agricultural practices and modern input



With regard to the use of modern inputs, 32 percent of respondents in our sample indicated that fertilizer was the modern input that they most frequently used. Improved seeds, pesticides, and organic farming methods were reported as the next most frequently used modern inputs, accounting for 24, 23, and 20 percent of the responses, respectively.

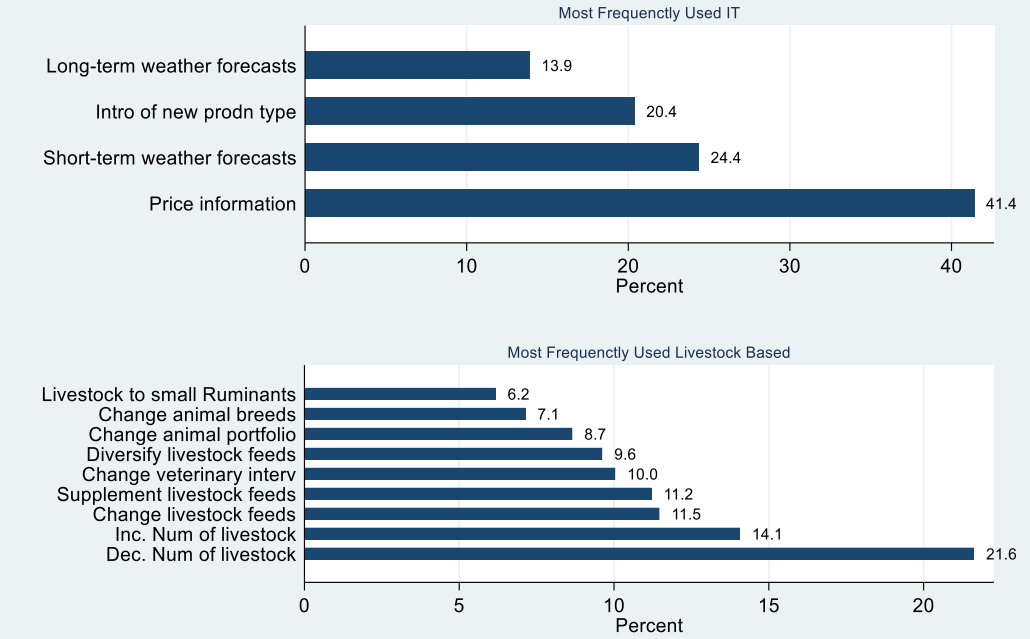
Figure 5.22 presents the most commonly used tools and machinery and water and soil conservation techniques among respondents in the survey. Spraying machines, ploughers, and harvesters were the most frequently used, accounting for 29, 20, and 15 percent, respectively, of responses. Looking at the usage of water and soil conservation techniques, terracing was the most frequently used technique, reported by 60 percent of the households.

Figure 5.22: Most frequently used technology types A



Respondents were also asked about their use of information technology and livestock-based adaptation strategies. The responses are summarized in Figure 5.23. With regard to the usage of information technology, 41 percent of respondents indicated that they used information technology to get information about prices. Where households also used information technology to get short-term weather forecasts and information about new product types, this was relatively limited. With regard to livestock-based practices, reducing the number of livestock was the most commonly used strategy, with 22 percent of households reporting having used this practice.

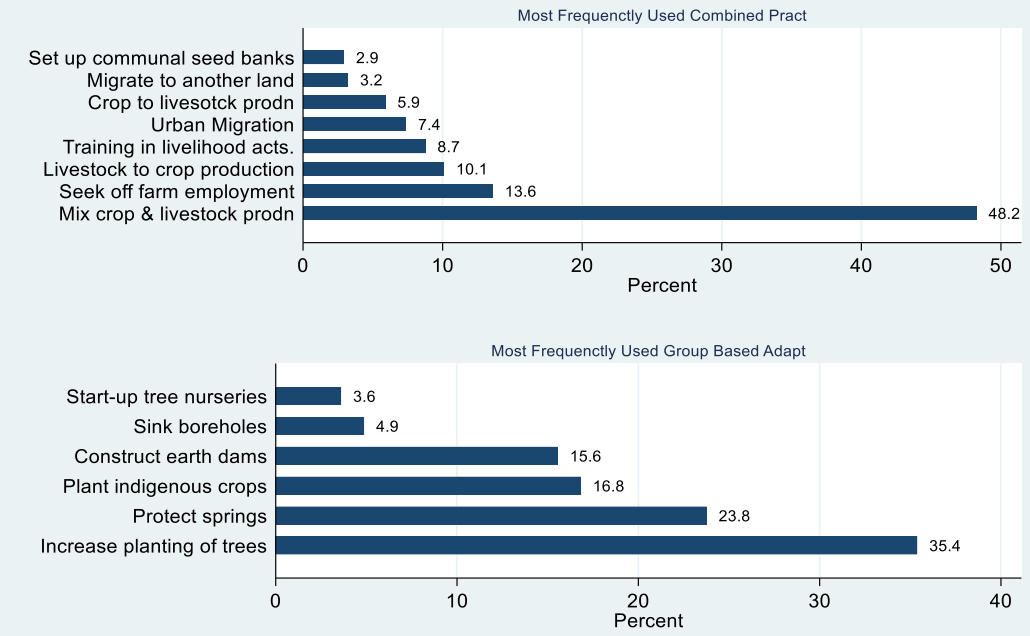
Figure 5.23: Most frequently used technology types B



Source: Own Computation based on RCC Survey 2021

Finally, Figure 5.24 provides information on the most frequently used combined practices and group-based adaptation techniques. With regard to combined practices, mixing crops and livestock production was the dominant approach, accounting for 48 percent of responses. Seeking off-farm employment and switching from livestock to crop production were second and third on the list, respectively, accounting for 14 and 10 percent of responses. Finally, 35 percent of households indicated that increasing tree planting was the most frequently used approach regarding group-based adaptation techniques. Protecting springs, planting indigenous crops, and protecting earth dams were other group-based adaptation techniques highlighted by respondents, accounting for 24, 17, and 16 percent, respectively, of responses.

Figure 5.24: Most frequently used technology types C



Source: Own Computation based on RCC Survey 2021

5.3.3 Resilience Capacity: Anticipatory

Another important aspect of resilience is anticipatory capacity, which refers to the capacity to foresee climate extremes before a shock occurs through repeated learning, early warning systems, or short-term weather forecast information. In the survey, respondents were asked how likely their household was to be fully prepared in advance if a drought were soon to occur. Table 5.8 summarizes the responses both for the overall sample and disaggregated by gender and education level of the household head.

Table 5.8: Preparedness for future drought-induced threats, by gender and education

	Likely prepared	Neutral	Unlikely prepared
Male	14.6	14.6	70.8
Female	8.2	14.8	77.1
Illiterate	10.3	15.4	74.3
Primary	14.7	13.8	71.5
Secondary and above	24.6	14.5	60.9
Total	13.4	14.7	72.0

Source: Own computation based on RCC Survey 2021

As can be seen from Table 5.8, 72 (13) of the households in the sample responded that they were unlikely (likely) to be fully prepared for future drought-induced threats, and the remaining 15 percent were neutral. When we look at the gender disaggregation, a higher proportion of male-headed households (15 percent) than female-headed households reported

that they were likely to be fully prepared for future drought shocks. In the case of female-headed households, only 8 percent were optimistic about their ability to be fully prepared for future drought shocks. Households' perceptions of the likelihood that they would be prepared for future droughts also varies by the level of education of the household head. As is apparent from Table 5.8, as the education level of the household head increases (decreases), the likelihood of being fully prepared for future drought shocks increases (decreases).

In Table 5.9, we disaggregate the responses by region. We see that, while a higher proportion of households in all regions indicated that they were unlikely to be fully prepared for future drought threats, households in Oromia and SNNPR seemed to be less pessimistic about their preparedness ability relative to households in other regions.

Table 5.9: Preparedness for future drought-induced threats, by region

	Likely prepared	Neutral	Unlikely prepared
Amhara	11.5	7.1	81.5
Oromia	20.4	25.8	53.8
Somali	21.0	20.0	59.0
SNNPR	9.2	10.2	80.6
Gambela	6.0	17.0	77.0
Dire Dawa	12.0	18.0	70.0

Source: Own computation based on RCC Survey 2021

In Table 5.10, households' perceptions of their ability to be fully prepared for future drought shocks is disaggregated by participation in different programmes and engagement in non-farm activity. In all cases, programme non-participants appear to have a more optimistic view than programme participants about their preparedness for future drought-induced threats. However, we should not read too much into these results as differences in perception following programme participation can reflect the systematic difference in the characteristics of programme participants and non-participants. Moreover, a higher proportion of households with non-farm income than those without non-farm income responded that they were likely to be more prepared for future drought shocks.

Table 5.10: Preparedness for future drought-induced threats, by programme participation

	Likely prepared	Neutral	Unlikely prepared
PSNP non-participant	14.8	15.7	69.6
PSNP participant	9.1	11.4	79.5
SLMP non-participant	13.3	13.6	73.1
SLMP participant	8.5	17.6	73.9
AGP non-participant	12.3	14.0	73.7
AGP participant	10.3	22.1	67.7
HH w/o non-farm income	12.6	15.7	71.7
HH with non-farm income	15.4	11.9	72.7

Source: Own computation based on RCC Survey 2021

Table 5.11 disaggregates the probability of a household being fully prepared for drought by the number of droughts. Compared to households which had been exposed to at least one drought episode in the previous five years, households which had not experienced any drought in the previous five years were more likely to be fully prepared for future drought-induced shocks. As the number of droughts that households experienced in the past five years increases, the proportion of households likely to be prepared for future drought-induced threats decreases. This is particularly the case for households exposed to two droughts or above in the past five years.

Table 5.11: 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	14.3	16.2	69.5
Number of droughts=1	11.8	8.2	80.0
Number of droughts=2	13.1	11.0	75.9
Number of droughts=3	2.9	14.3	82.9
Number of droughts=4	0.0	6.7	93.3
Number of droughts=5	0.0	0.0	100.0

Source: Own computation based on RCC Survey 2021

In the survey, respondents were asked whether they agreed with the statement, ‘your household learned important lessons from past drought shocks and is fully prepared for a drought event that may occur in the future’. As we can see from Figure 5.25, 64 percent of respondents disagreed with this statement. This shows that there was a limited learning effect from repeated past droughts.

Figure 5.25: Households learned lessons from past droughts

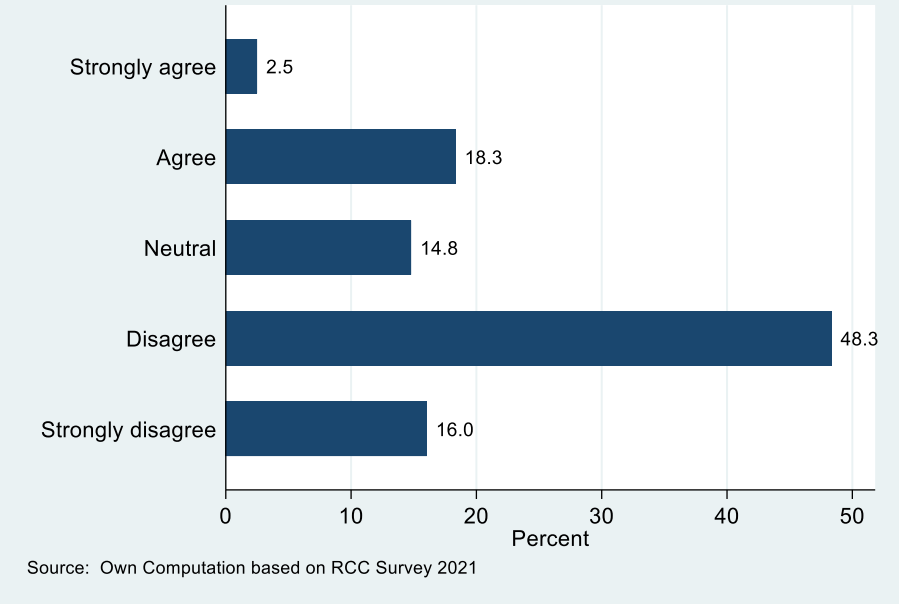
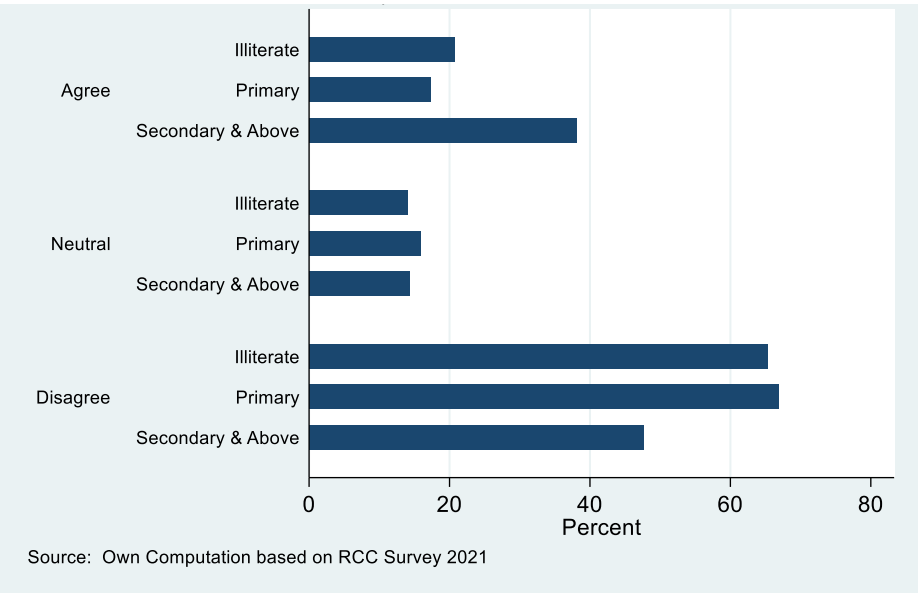


Figure 5.26: Households learned lessons from past droughts, by level of education



There were differences in the households' perceptions about the learning effect of past droughts based on education level and gender of the household head (see Figures 5.26 and 5.27). Male-headed households and households with more-educated heads (secondary level and above) were less likely to disagree with the statement that their household had learned an important lesson from past drought shocks. When looking at the regional differences in the households' perceptions about the learning effect of past drought experience, relatively speaking, households in Somali and Oromia seem to have agreed more compared to households in other regions.

Figure 5.27: Lessons from past droughts, by gender of the household head

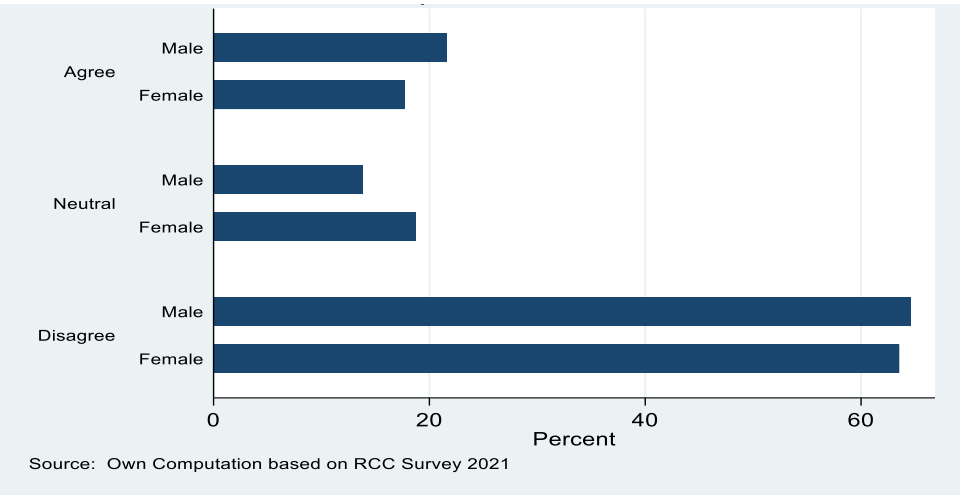
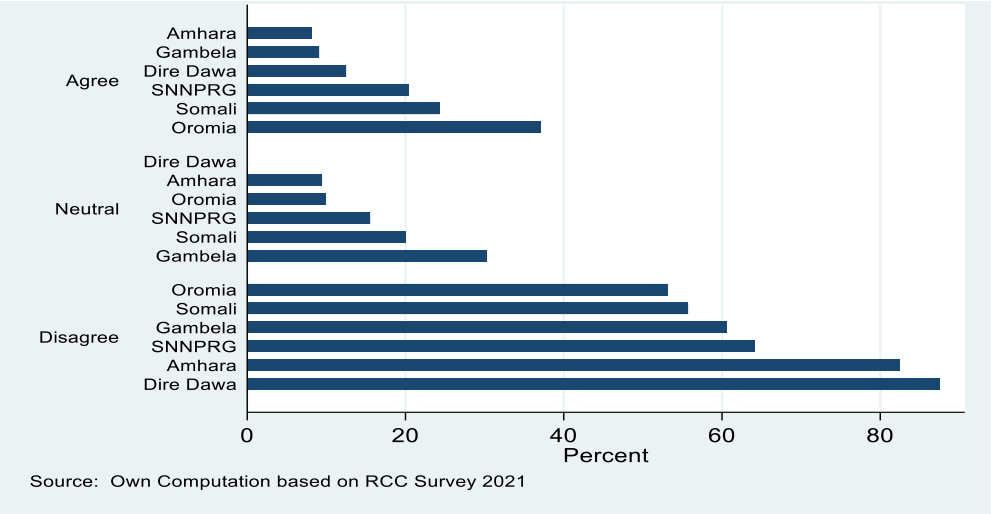


Figure 5.28: Households lessons from past droughts, by region



Finally, respondents in the survey were asked about their access to climate information, how useful the information was for decisions about agricultural practices, and what other information sources they used to make decisions about agricultural operations. This information is summarized in Table 5.12. Only 21 percent of the total sample of 2,000 households indicated that they had had access to temperature and rainfall information during the last agricultural season. Out of these, about 16 percent had used the forecast information to decide which agricultural practices to follow. Of this total, about 96 percent responded that they had found the climate forecast information to be reliable for their decision. Households which had had no access to climate information in the last agricultural season and those which had not found the available climate forecast information reliable for their decision had used other sources of information to make decisions about their agricultural practices. These

alternative information sources included traditional tellers, own experience, and neighbours' experience, accounting for 19, 70, and 10 percent, respectively, of responses.

Table 5.12: Access to climate information

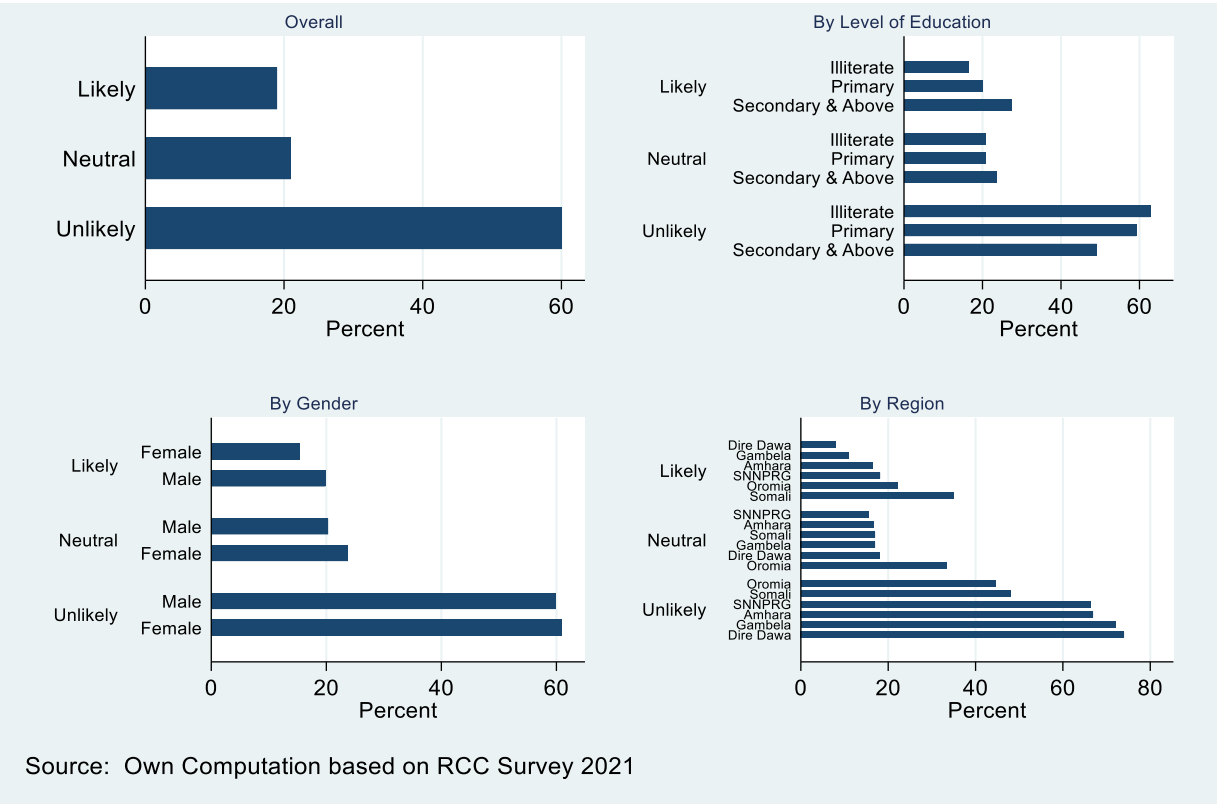
	% Yes	Number Yes	Number No	Total
Access to climate information	21.2	424	1,576	2,000
Used forecast information	15.8	316	1,684	2,000
Found information useful	95.6	302	14	316
Traditional tellers	19.0	324	1,383	1,707
Own experience	70.1	1,196	511	1,707
Followed neighbour experience	9.7	166	1,541	1,707

Source: Own computation based on RCC Survey 2021

5.3.4 Resilience Capacity: Transformative

The fourth component of resilience capacity is transformative capacity, which captures long-term aspects related to system-level changes, changes in social structure, policy shifts, and institutional changes. In the survey, households were asked a variety of questions to obtain information about their perceptions of their transformative capacity.

Figure 5.29: Adaptation to threat by changing primary source of income

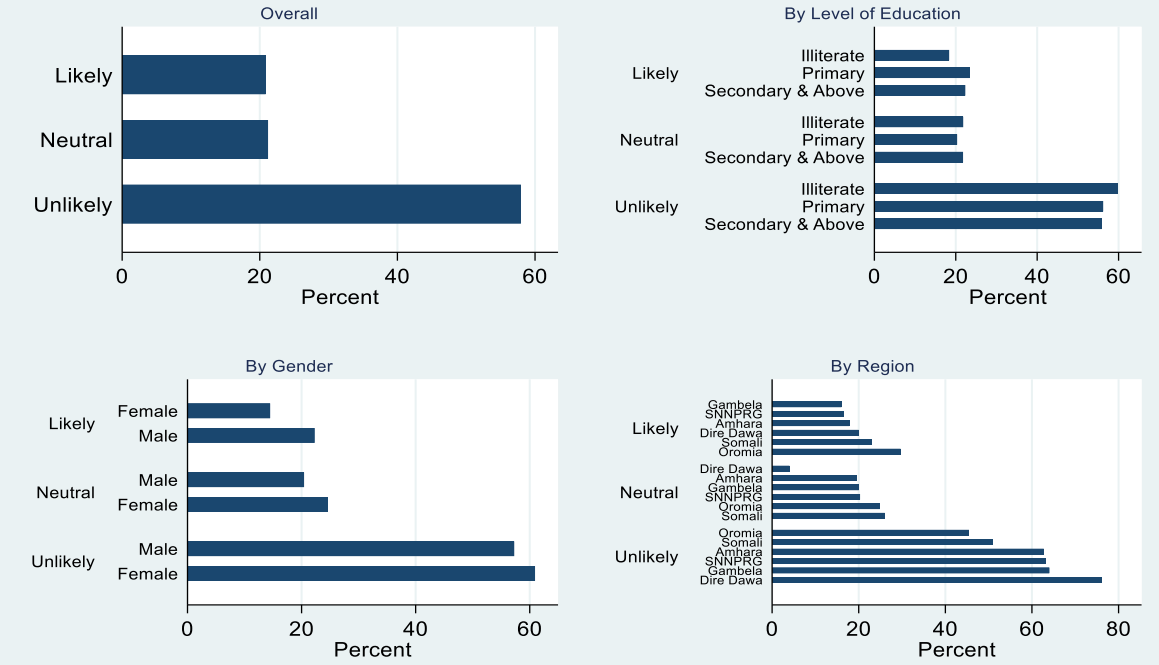


Source: Own Computation based on RCC Survey 2021

In particular, respondents were asked how likely their household was to change its primary source of income or livelihood if a drought occurred in the future. As Figure 5.29 shows, a

higher proportion (60 percent) of households in the sample responded that their household was unlikely to change its primary source of income if a drought occurred in the future.

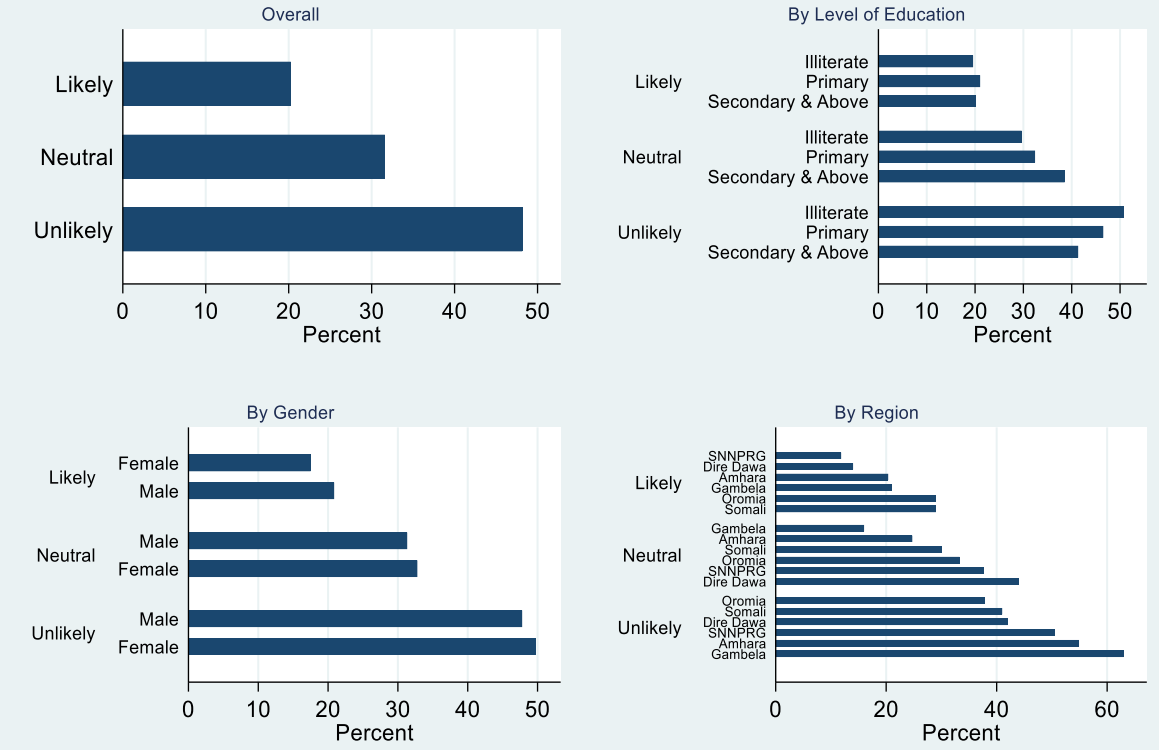
Figure 5.30: Adaptation to a drought-induced threat by changing way of life



Source: Own Computation based on RCC Survey 2021

Moreover, as Figure 5.30 shows, a higher proportion of households responded that they were unlikely to adapt to a drought-induced threat by changing their way of life. Finally, pastoralists were asked whether they would change their livelihood from a pastoral to a sedentary system following frequent occurrence of droughts. Figure 5.31 presents this information for the overall sample and disaggregated by different categories. We found that only 20 percent of respondents thought that they could transform their livelihood from pastoral to sedentary farming following frequent droughts. Taken together, the information presented in Figures 5.29 to 5.31 shows the limited transformative capacity of households in the sample.

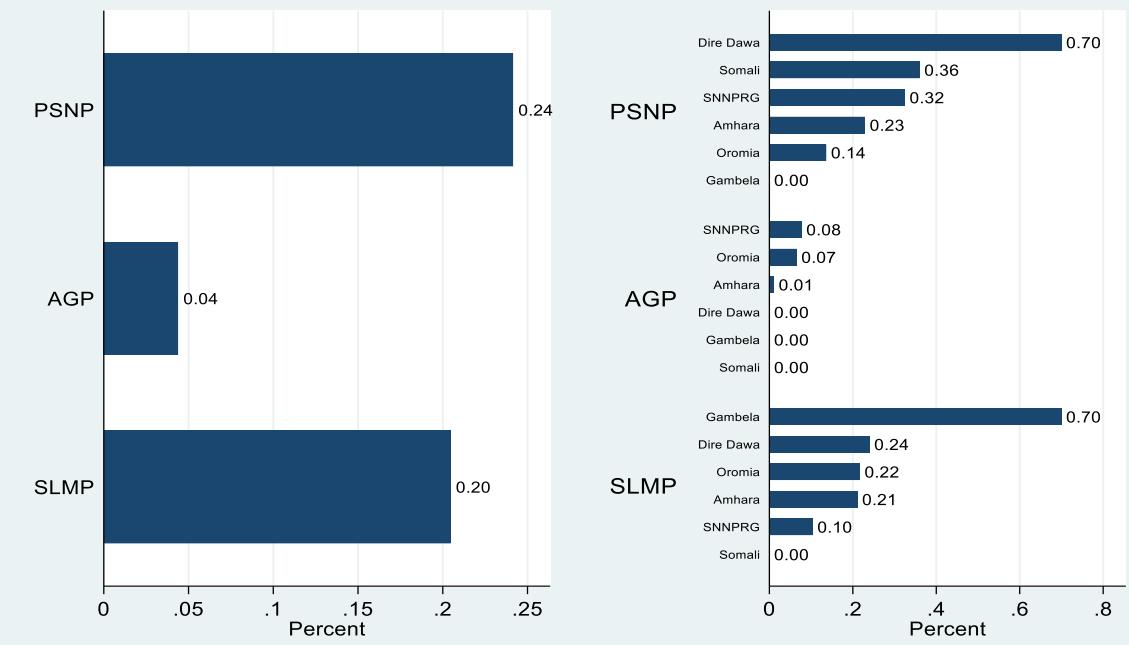
Figure 5.31: Adaptation to threat by changing from pastoralist to sedentary system



Source: Own Computation based on RCC Survey 2021

Supportive government programmes are believed to be a key component of transformative capacity. In the survey, households were asked about their participation in three major programmes, namely the PSNP, SLMP, and AGP. The information from their responses is summarized in Figure 5.32.

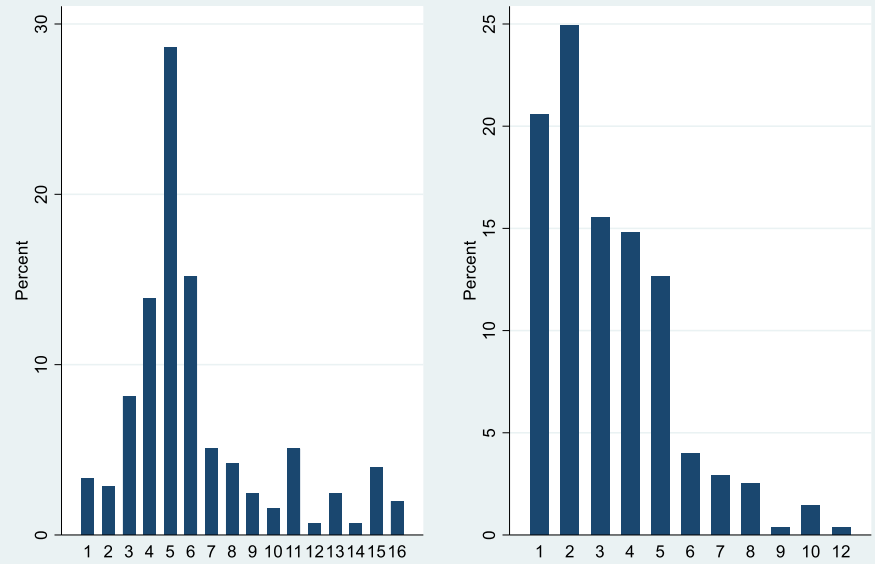
Figure 5.32: Participation in government programmes, overall and by region



Source: Own Computation based on RCC Survey 2021

From the total sample of 2,000 households, 24 percent had participated in the PSNP, 4 percent in the AGP, and 20 percent in the SLMP. The durations of PSNP (the figure on the left) and SLMP (the figure on the right) are shown in Figure 5.33. While most PSNP participant households had participated for four to six years, in the case of SLMP, most households had participated for under five years.

Figure 5.33: Duration of participation in PSNP and SLMP, in years



Source: Own Computation based on RCC Survey 2021

Table 5.13 presents details about the assets created by the different programmes and the number of households which had participated in each of the infrastructures created by government programmes.

Table 5.13: Infrastructure created by government programmes

Type of infrastructure	No.	%	PSNP No.	PSNP %	AGP No.	AGP %	SLMP No.	SLMP %
Access road	196	24.6	118	60.2	36	18.4	42	21.4
Water-harvesting	122	15.3	28	23.0	86	70.5	8	6.6
Soil and water conservation (communal)	291	36.6	144	49.5	12	4.1	135	46.4
Soil and water conservation (private)	106	13.3	54	50.9	4	3.8	48	45.3
Other natural resource	15	1.9	12	80.0	2	13.3	1	6.7
School	25	3.1	23	92.0	0	0.0	2	8.0
Health post	10	1.3	9	90.0	1	10.0	0	0.0
Springs/shallow well	10	1.3	1	10.0	5	50.0	4	40.0
Other (specify)	21	2.6	5	23.8	16	76.2	0	0.0
Total	796	100	394	100.0	162	100.0	240	100.0

Source: Own computation based on RCC Survey 2021

CHAPTER 6: HYPOTHETICAL GAMES

HIGHLIGHTS:

- A third of respondents played a neutral game in which they were asked to guess the value of an object in a picture. The majority of respondents guessed, within the acceptable range, the number of rooms in the Kebele office and the number of people required to thatch a roof. Around 45 percent of respondents correctly guessed the weight of a teff bag and the number of seats on a bus. The lowest score was for the combined age of a pair of oxen, which 35 percent guessed correctly.
- Another third of respondents played a conflict game in which they were asked general questions that were cross-checked against an acceptable range. Only about 9 percent guessed the ETB amount from renting a pair of oxen for a full season within the acceptable range, and 11 percent correctly guessed the number of days it takes to resolve domestic conflict in a court.

6.1 Risk and Time Preferences

This section of the survey presents the risk and time preference-generating hypothetical games. The risk preference game involved questions set up as a choice experiment on a hypothetical farm. Each choice consisted of a pair of good and bad outcomes, each with a 50 percent probability of occurring. This enabled calculation of the expected gains (i.e. the average of the two outcomes) and the spread (i.e. the difference between the two outcomes). The categories in the risk preference experiment represented the extent to which respondents were willing to make risky choices. Accordingly, the extreme risk aversion category represented households which were willing to take the smallest spread in gains and losses, followed by severe, moderate, intermediate, and slight risk aversion categories. In contrast, the neutral risk aversion category corresponded to respondents who were willing to take the biggest spread in gains and losses.

The experimental set-up for the time preference game was also hypothetical. Each respondent was given a choice between a specific amount of money to be received on a given day (a more immediate, smaller payment) and an alternative amount to be received on the same date one year later. The choices were arranged in such a way that the difference between the present and future amounts was randomly sequenced. The time preference rate was implied (as

a range) by a switch of choice from an early reward to a delayed reward, giving a measure of the time preference rate for each respondent.

The risk and time preferences were not computed for this report as computation of the corresponding coefficients was analytical rather than descriptive and will be a significant part of the analysis in writing a future paper.

6.2 Guessing-game Experiment: Question and Design

The experimental design for the game involved giving individuals different scenarios for playing a guessing game. These included no game, neutral, and subtle cues to conflicts. The premise of the games was that compared to the control (no game) group, playing the guessing game would enable participants to awaken their sense of thinking through numbers. The purpose of priming respondents to subtle cues to conflict was to investigate the degree to which the possibilities of sharing and conflict would impact on their attitude towards the management and utilization of post-harvest grazing resources.

6.2.1 Guessing-game Experiment: Results

Our guessing-game experiment divided the respondents (2,000 in total) into three groups: those who played no game (32.9 percent), those who played a 'neutral game' (33.9 percent) and those who played a 'conflict game' (33.25 percent). Thus, there was a fair distribution of respondents between the games. Those who played the 'neutral game' were shown pictures associated with the questions asked to help their guesses to fall within the acceptable range. For example, we showed our respondents a picture of a sack of teff and asked them to guess its weight. The acceptable weight range was set at 48 kg to 78 kg. About 44 percent guessed within the range, with their mean guess and corresponding standard deviation of 72.7 and 24.8, respectively. Similarly, respondents were shown a picture of a Kebele office and were asked to guess the number of rooms it contained. The guesses of 98.8 percent of respondents fell within the acceptable range (1-4 rooms), with corresponding mean and standard deviation guess values of about 2.4 and 3.1, respectively. Of those who guessed the number of seats in a bus in a picture, 45.4 percent guessed within the acceptable range (20-30 seats), with mean and standard deviation guess values of about 35 and 17.5, respectively. In addition, 35.1 percent of those who were asked to guess the combined age of a pair of oxen (shown in a picture) guessed within the acceptable range (5-10 years), with mean and standard deviation values of about 14.1 and 8.7, respectively. Finally, 59.5 percent of respondents who guessed the number of people required to thatch a house (shown in a picture) did so within the

acceptable range (7-30 people), while the corresponding mean and standard deviation guess values were about 23.6 and 32.1 respectively. Table 6.1 summarizes the results of our guessing-game experiment.

Table 6.1: Guessing-game experiment

Respondents who guessed	Acceptable range	Within range (%)	Mean	SD
Neutral game				
Weight of a bag of teff (kg)	48-78	44.4	72.7	24.8
Number of rooms in a Kebele office	1-4	98.8	2.4	3.1
Number of seats in a bus	20-30	45.4	35.0	17.5
Combined age of a pair of oxen	5-10	35.1	14.1	8.7
Number of people required to thatch a house	7-30	59.5	23.6	32.1
Conflict game				
Number of regions that produce teff	4-6	41.0	5.1	6.7
Number of days it takes to resolve domestic conflict in a court	7-30	11.7	31.0	62.2
Number of days it takes to travel from here to Mekelle	1-3	61.1	4.1	5.1
ETB amount from renting a pair of oxen for full season	100-400	9.5	7495	8236
Number of years one keeps a house if built on contested land	1-4	28.7	40.3	96.1
Number of respondents who played (and %) - no game	658	32.9		
Neutral game	677	33.9		
Conflict game	665	33.3		
Total	**2,000**	**100**		

Source: Own computation based on RCC Survey 2021

The respondents who played the 'conflict game' (their summary results are shown in Table 6.1) were asked some general questions, and their responses were cross-checked against acceptable ranges. For example, about 41 percent of those who were asked to guess the number of regions that produce teff did so within the acceptable range (4-6 regions), with corresponding mean and standard deviation guess values of about 5.1 and 6.7, respectively. Among the respondents who were asked to guess the number of days it takes to resolve domestic conflict in a local Kebele court, only about 11.7 percent guessed within the acceptable range (7-30 days), with mean and standard guess values of 31 and 62.2, respectively. Similarly, about 61.1 percent of those who guessed the number of days it takes to travel from their residence to Mekelle did so within the acceptable range (1-3 days), with mean and standard deviation guess values of about 4.1 and 5.1. About 9.5 percent of respondents who guessed the amount of ETB from renting a pair of oxen for a full season guessed within the acceptable range (ETB 100-400), with the mean and standard deviation guess values of about 7,495 and 8,236, respectively. Finally, about 28.7 percent of respondents who guessed the number of years a person would keep a house for if built on contested land did so within the acceptable

range (1-4 years), with mean and standard deviation values of about 40.3 and 96.1, respectively.

6.2.2 Follow-up Questions: Community Grazing and Area Closures

Along with the guessing-game experiment, some follow-up questions about community grazing land and area closures (to allow re-growth) were asked of all respondents. Overall, a slightly higher proportion of farm households stated that there was community grazing land in their locality than stated that there was area closure in their neighbourhood (i.e. 37.9 percent vs 31 percent, respectively). For those farm households that had community grazing land, the land was, on average, about sixteen minutes' walking distance from their homestead (with a standard deviation of about 17 minutes). Table 6.2 summarizes the resulting descriptive statistics.

Table 6.2: Community grazing land and area closure

Proportion of farm households that had	**Yes**	**No**
Community grazing land	37.9	62.1
Area closure in their neighbourhood	31	69
Total number of observations	2,000	
Of those households that had community grazing land	**Mean**	**SD**
Average walking distance (minutes) from homestead	16.0	17.0
Number of observations	758	

Source: Own computation based on RCC Survey 2021

To try to understand how the farm households would respond to interventions to restore and conserve the environment, we developed a set of questions to capture the degree of commitment of the farmers. We divided the environment issues in two: (1) outcome variables on the grazing lands and area closures, and (2) mechanism variables on the overall environment.

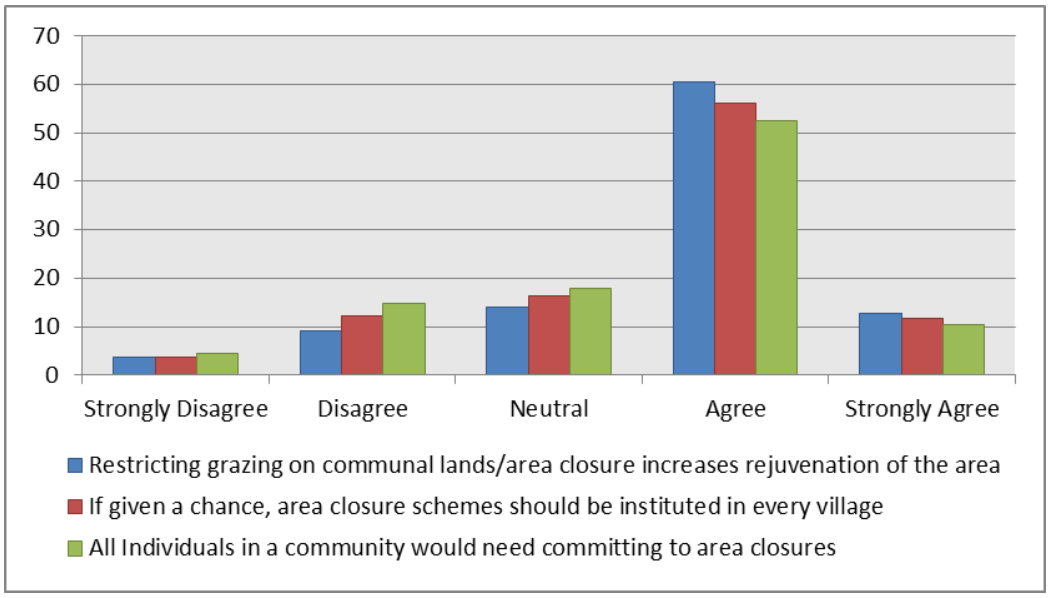
Starting with the outcome variables, we asked our respondents the degree to which they agreed (disagreed) with the following three statements:

1. Restricting grazing on communal land/area closure is important for increasing the rejuvenation of the area;
2. If given a chance to, area closure schemes should be instituted in every village; and
3. All individuals in a community would need to commit to area closures.

Overall, a large majority of farmers agreed or strongly agreed with each of the three statements (about 73 percent, 68 percent, and 63 percent with statements 1., 2., and 3.,

respectively). Further observation of their reactions showed that, while about 4 percent of the farmers strongly disagreed with each statement, about 13 percent, 12 percent, and 10 percent strongly agreed with statements 1., 2., and 3., respectively. Similarly, 60.6 percent agreed and 9.2 percent disagreed with statement 1., 56.2 percent agreed and 12.1 percent disagreed with statement 2., and 52.6 percent agreed and 14.8 percent disagreed with statement 3. Fourteen percent, 16 percent, and 18 percent were neutral about statements 1., 2., and 3. respectively. Figure 6.1 summarizes the extent to which farm households agreed or disagreed with the above three statements about community grazing land and area closures.

Figure 6.1: Reactions to communal grazing lands and area closures



Source: Own computation based on RCC Survey 2021

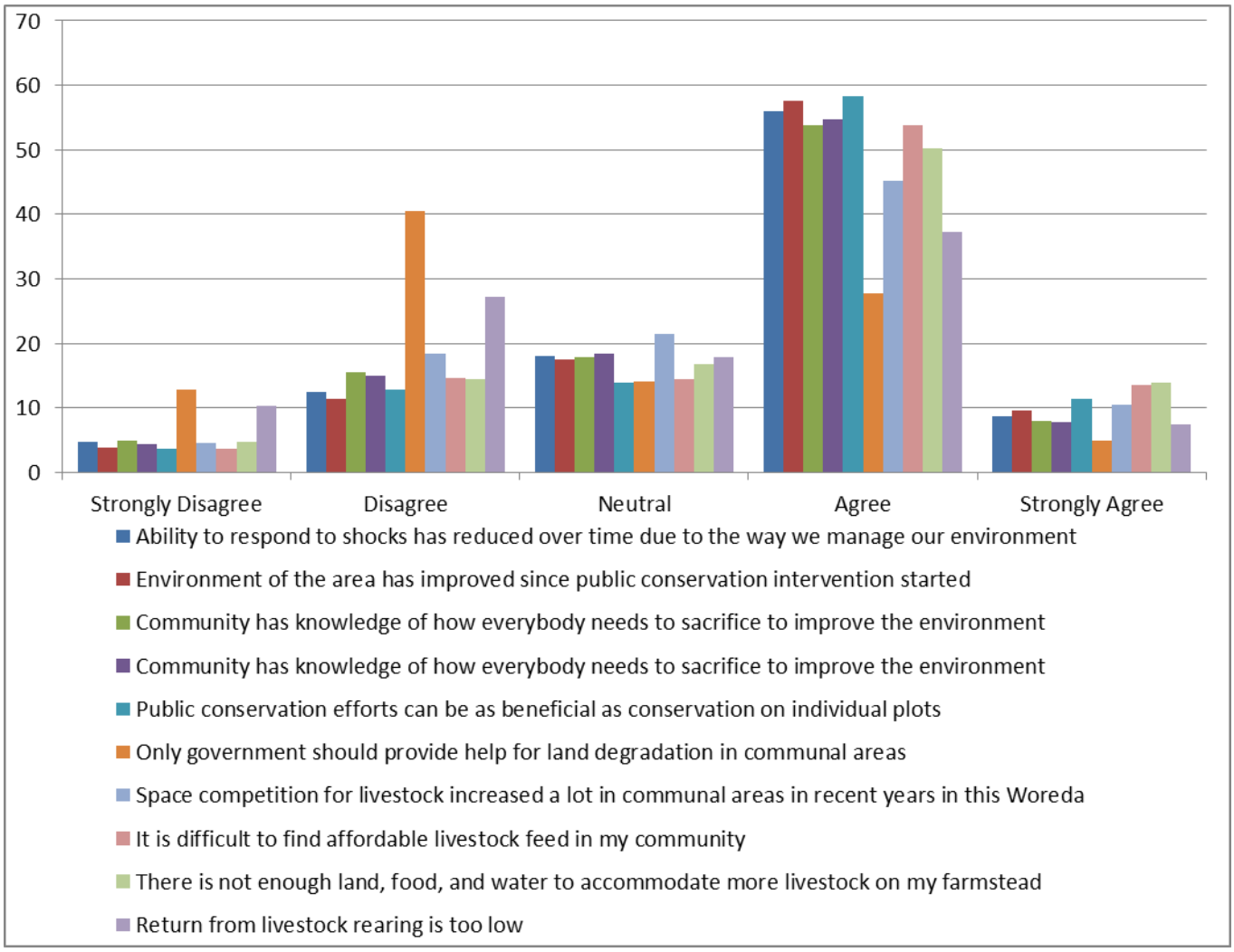
With regard to the mechanism variables, respondents were asked about the degree to which they agreed (disagreed) with the following statements:

1. The ability to respond to shocks has reduced over time due to the way we manage our environment;
2. The environment of the area has improved since the public conservation intervention started;
3. Local community members have a good understanding of how everybody needs to make sacrifices to make the environment better;
4. Public conservation efforts can be as beneficial as conservation on individual plots;
5. Only government should provide help for land degradation in communal areas;

6. Space competition for livestock increased a lot in communal areas in the recent years in this Woreda;
7. It is difficult to find affordable livestock feed in my community;
8. There is not enough land, food, and water to accommodate more livestock than I have in my farmstead; and
9. I believe that the return from livestock rearing is too low.

Overall, the majority of farmers reacted affirmatively to all but two of the above statements. The exceptions related to statements about the need for the government to provide support in the case of degradation of communal lands and about the minimal return on livestock rearing, where about 53 percent and 37 percent of farmers either disagreed or strongly disagreed, respectively. This exception can also be observed in the pattern of strong reactions at both tails. The proportion of farmers who disagreed strongly with these two statements was also larger than the proportion of those who strongly agreed with these same statements. In addition, the share of farmers who were neutral about all the statements was relatively significant (compared to the strong ratings at both extremes). The shares were as high as about 21.5 percent and 18 percent each for the statements relating to increasing space competition for communal grazing land, the decline in ability to respond to shocks, and the minimal returns to livestock rearing. Figure 6.2 summarizes the extent to which farmers agreed or disagreed with the above nine statements about the environment.

Figure 6.2: Farmers' reactions to environment issues



Source: Own computation based on RCC Survey 2021

CHAPTER 7: SUMMARY

The University of Copenhagen Development Economic Research Group (UCPH-DERG) and the Policy Studies Institute (PSI) of the Ethiopian Government signed a partnership agreement to implement a five-year research project starting in April 2019. The research project's objective was 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 household survey. The survey covered 2,000 households and 40 Woredas drawn from five regional states (Amhara, Oromia, Somali, Gambela and SNNPR) and one City administration (Dire Dawa). The survey included questions on household characteristics, agricultural production and technologies, wealth and consumption, drought and resilience capacities, and a guessing-game experiment to evaluate farmers' time and risk preferences. The households were characterized by having an average household size of 5.5 people with an almost equal distribution of males and females. However, household heads were mainly men, with only 18 percent of household heads being female. The households primarily engaged in agriculture, and nearly half of the household heads were illiterate.

The farm households mainly produced cereals, with maize and teff being the most and second most important crops as well as being the two key food security crops. However, the households consumed a large proportion of their cereals, indicating that cereals were less commercialized than cash crops, spices, vegetables, and fruits, a relatively higher share of which were sold than consumed when compared to cereals. This was also clear in relation to household consumption, where cereals and grains were the most consumed food group and vegetables and fruits were the second least consumed group. Few households engaged in non-farm activities, with only about 36 percent selling processed foods and 21 percent selling firewood, homemade charcoal, timber for construction, wooden poles, etc.

Around 24 percent of households had been exposed to at least one drought in the past five years, while the rest had not experienced any droughts during this period. When coping with drought, consumption adjustment was the dominant coping strategy, followed by selling livestock. The households demonstrated limited absorptive capacity as the majority believed they were less likely to have the capacity to reduce the immediate impact of drought on their livelihood. With regard to self-perception of the likelihood of recovering from future drought damage, the likelihood increased by the number of droughts and educational level of the household head. However, a higher proportion of households believed they were unlikely to

adapt to future drought-induced threats, and the majority of the households reported that they were unlikely to change their primary source of income if a drought occurred in the future.

The use of extension services, irrigation, and improved seeds was relatively rare in both harvest seasons. Access to an agricultural extension service was regarded as a major source of information about agricultural activities and natural resource conservation for farming households. It was believed that the positive effect of extension contacts meant that farmers who had contact with extension agents tended to adopt adaptation measures in response to the changing climate. Despite water stress in agriculture being a global threat, investment in soil water conservation and irrigated agriculture was low. A major challenge was the shortage of irrigation water sources, followed by a lack of motor pumps and conflict in water use.

Finally, the respondents were asked to play two games. A third played a neutral game in which they were shown pictures associated with the questions and were asked to guess the value of the object in the picture. The majority of respondents guessed, within the acceptable range, the number of rooms in a Kebele office and the number of people required to thatch a roof. Around 45 percent of respondents correctly guessed the weight of the teff bag and number of seats on a bus, while the lowest-scoring object was the combined age of a pair of oxen, which 35 percent guessed correctly.

Another third of respondents were asked to play a conflict game where they were asked general questions that were cross-checked against acceptable ranges. Only about 9 percent guessed, within the correct range, the ETB amount from renting a pair of oxen for a full season, followed by 11 percent who correctly guessed the number of days it takes to resolve domestic conflict in a court.

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Cover page photos (front and back side) were taken during qualitative survey held February 2021.

Front page

- Gabiyon work to protect from erosion is from Wolmera district (Berfteta Lameffa village) – Holeta – Oromia Region

Back page

- Small scale irrigation cannel from Limu Seka woreda – Jima zone
- Taro from Mejang zone Gambela
- Improved high yield potato variety from Muhurena Akili – Gurage zone (SNNPR)
- Newly adopted apple variety from Muhurna Akili – Gurage zone (SNNPR)
- Fodder saving for dry season also from the same woreda and zone