



# SENEGAL'S MULTIDISCIPLINARY WORKING GROUP CIS MODEL: A QUALITATIVE ASSESSMENT OF CIS USERS AND THEIR NEEDS



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Cover Photo: Village view from an area in Senegal covered by the MWG Credit:  
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# **Senegal's Multidisciplinary Working Group CIS Model: A Qualitative Assessment of CIS Users and their Needs**

Learning Agenda for Climate Services in  
Sub-Saharan Africa

## **DISCLAIMER**

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# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b> .....	<b>VIII</b>
METHODS AND APPROACH .....	IX
GOAL 1: THE MWG MODEL: CURRENT AWARENESS, UPTAKE AND USE, AND FUTURE PATHWAYS OF CHANGE.....	IX
GOAL 2: LESSONS ABOUT THE MONITORING AND EVALUATION OF WEATHER AND CLIMATE SERVICES FROM THE USE OF LIG .....	X
GOAL 3: FILLING GAPS IN THE CISRI LEARNING AGENDAS .....	XI
SUMMARY .....	XII
<b>1. INTRODUCTION</b> .....	<b>1</b>
<b>2. CIS PROJECT CONTEXT: THE MULTIDISCIPLINARY WORKING GROUP MODEL IN SENEGAL</b> .....	<b>2</b>
<b>3. METHODOLOGY</b> .....	<b>4</b>
3.1. CRITERIA FOR SITE SELECTION .....	6
3.2. DATA COLLECTION .....	7
3.3. DATA ANALYSIS .....	8
3.3.1. <i>Translation</i> .....	8
3.3.2. <i>Coding</i> .....	8
3.3.3. <i>Establishing the nature of livelihood decision making</i> .....	8
3.3.4. <i>Checking analysis against reported sub-group vulnerabilities</i> .....	9
<b>4. VULNERABILITY CONTEXT: LIVELIHOODS ZONE SN10: RAINFED GROUNDNUTS AND CEREALS</b> .....	<b>11</b>
4.1. LIVELIHOODS ZONE 10: VULNERABILITY CONTEXT.....	11
4.2. COMPARING VULNERABILITY CONTEXTS WITHIN LIVELIHOODS ZONE 10.....	18
4.3. SUMMARY OF THE VULNERABILITY CONTEXT.....	23
<b>5. IDENTITY IN ZONE SN10</b> .....	<b>23</b>
<b>6. DISCOURSES OF LIVELIHOODS IN ZONE 10</b> .....	<b>27</b>
6.1. COMPARING THE ACTIVITIES OF NGETOU MALICK AND PANAL.....	28
6.2. LIVELIHOODS BY VULNERABILITY GROUP .....	35
6.2.1. <i>Surplus Production Livelihoods</i> .....	36
6.2.2. <i>Secure Subsistence Livelihoods</i> .....	44
6.2.3. <i>Limited Resource Livelihoods</i> .....	51
6.2.4. <i>Summary</i> .....	58
<b>7. TOOLS OF COERCION IN ZONE 10</b> .....	<b>58</b>
<b>8. ASSEMBLAGES OF VULNERABILITY AND THE LOGIC OF LIVELIHOODS</b> ...	<b>61</b>
<b>9. CLIMATE SERVICES IN ZONE SN10: EXPLAINING CURRENT UPTAKE</b> .....	<b>67</b>
9.1. WHAT IS BEING DELIVERED? .....	67
9.2. WHAT INFORMATION DO FARMERS USE TO INFORM LIVELIHOODS DECISIONS? .....	68
9.3. HOW MUCH DO FARMERS KNOW ABOUT THE MWG ADVICE? .....	71
9.4. WHAT REASONS DO RESIDENTS GIVE FOR NOT USING THE INFORMATION?.....	72
<b>10. FORMULATING EFFECTIVE DESIGN PROCESSES AND IMPACT EVALUATIONS FOR CIS</b> .....	<b>75</b>
10.1. SAMPLE STRATIFICATION .....	76

10.2.	IDENTIFYING UPTAKE AND USE .....	76
10.3.	IDENTIFYING IMPACTS OF USE IN ZONE SN10 .....	77
<b>11.</b>	<b>ADVANCING THE DESIGN, MONITORING, AND EVALUATION OF CIS ....</b>	<b>80</b>
	<b>REFERENCES.....</b>	<b>83</b>

## LIST OF FIGURES

Figure 3.1: Conceptual diagram of the LIG approach (Carr 2014).....	6
Figure 3.2: Locator map of Livelihoods Zone 10, and the villages of Ngetou Malick and Panal. ....	7
Figure 4.1: The vulnerability context of Ngetou Malick, as reported by residents interviewed for this project.....	12
Figure 4.2: Overview of vulnerability groups in Ngetou Malick.....	13
Figure 4.3: A comparison of the assemblages of vulnerability reported by members of each group in Ngetou Malick.....	14
Figure 4.4: The vulnerability context of Panal, as reported by residents interviewed for this project	15
Figure 4.5: A comparison of the assemblages of vulnerability reported by members of each group in Ngetou Malick.....	17
Figure 4.6: The compositions of the samples in the two villages by vulnerability group. ....	18
Figure 4.7: Comparison of the vulnerability contexts of the two villages .....	20
Figure 4.8: Comparing the assemblages of vulnerability for SPL across Ngetou Malick and Panal ...	21
Figure 4.9: Comparing the assemblages of vulnerability for SSL across Ngetou Malick and Panal....	22
Figure 4.10: Comparing the assemblages of vulnerability for LRL across Ngetou Malick and Panal	23
Figure 6.1: Livelihoods activities reported by residents of Panal and Ngetou Malick.....	28
Figure 6.2: Crop selections in Panal and Ngetou Malick.....	30
Figure 6.3: Average number of crops cultivated, by village and vulnerability group.....	31
Figure 6.4: Reported uses of crops from Panal and Ngetou Malick. Darker colors represent greater market sale of a crop, while blank cells represent crops either not cultivated in that village, or for which there was no reported use. ....	31
Figure 6.5: Garden crop selections in Panal and Ngetou Malick.....	33
Figure 6.6: Animal ownership in Panal and Ngetou Malick.....	34
Figure 6.7: SPL livelihoods activities reported by village.....	36
Figure 6.8: SPL livelihoods activities reported by village, gender, and seniority .....	38
Figure 6.9: SPL crop selection reported by village.....	39
Figure 6.10: SPL crop selection by village, gender, and seniority .....	40
Figure 6.11: Reported SPL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.....	42
Figure 6.12: SPL animal ownership by village .....	43
Figure 6.13: SPL animal ownership by village, gender, and seniority .....	44
Figure 6.14: SSL livelihoods activities reported by village.....	45
Figure 6.15: SPL livelihoods activities reported by village, gender, and seniority.....	46
Figure 6.16: SSL crop selection reported by village.....	47
Figure 6.17: SSL crop selection by village, gender, and seniority. ....	48
Figure 6.18: Reported SSL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.....	49
Figure 6.19: SSL animal ownership by village.....	50
Figure 6.20: SPL animal ownership by village, gender, and seniority .....	51
Figure 6.21: LRL livelihoods activities reported by village .....	52
Figure 6.22: LRL livelihoods activities reported by village, gender, and seniority. ....	53
Figure 6.23: LRL crop selection reported by village.....	54
Figure 6.24: LRL crop selection by village, gender, and seniority .....	55

Figure 6.25: Reported LRL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.....	56
Figure 6.26: LRL animal ownership by village .....	57
Figure 6.27: LRL animal ownership by village, gender, and seniority.....	58
Figure 8.1: Assemblages of vulnerability for those with SPL in Zone 10, by gender and village of residence.....	62
Figure 8.2: Assemblages of vulnerability for those with SSL in Zone 10, by gender and village of residence.....	64
Figure 8.3: Assemblages of vulnerability for those with LRL in Zone 10, by gender and village of residence.....	66
Figure 9.1: Sources of information used by residents of Panal to inform their agricultural and wider livelihoods decisions. ....	69
Figure 9.2: Sources of information used to inform livelihoods decisions in Panal, by vulnerability group.....	70
Figure 9.3: Sources of information used to inform livelihoods decisions in Panal, by gender. ....	71
Figure 9.4: The types of information residents of Panal reported receiving via the CIS (left), the number of types of information the average resident identified, and the percentages of residents who could identify any type of information. ....	71
Figure 9.5: Reported reasons why residents of Panal do not use the forecasts .....	73
Figure 9.6: Reported reasons why residents of Panal do not use the forecasts, by vulnerability group .....	74
Figure 9.7: Reported reasons why residents of Panal do not use the forecasts, by gender .....	75

## EXECUTIVE SUMMARY

A unique problem with the monitoring and evaluation of climate information services (CIS) for agriculture interventions is that CIS have no inherent value of their own. Their usefulness is predicated on the ability of farmers to make decisions that alter their farming practices and activities. As a result, the pathways through which the information results in observed outcomes, such as increased yield or the improved resilience of farming systems, are complex and dependent on other decisions, factors, and processes. For example, access to and uptake of climate information is mediated by complex and often context-specific interactions between social (such as gendered roles and responsibilities, or trust in the information provided) and economic (such as asset ownership or market prices) factors. These factors create different information needs and capacities to utilize this information within a community or even a household. Access, therefore, does not guarantee uptake or use. Even in a context where access may be assured and farmers can overcome barriers to the utilization of the information, it is difficult to directly attribute the provision of climate information to observed outcomes. These decisions are shaped by other sources of information, incentives and disincentives to utilize climate information, and their connections to wider everyday decisions that rural populations make about their livelihoods. In addition, because they are often bundled with other services or interventions, it is difficult to isolate the effect of CIS on livelihoods.

To articulate impact, an important task is to understand how a CIS intervention meets the particular needs of specific end users and through which pathways this information comes to influence not only agricultural decisions, but also broader livelihood decisions. Such information is important for the design of CIS that are more gender-responsive and that reach marginal and vulnerable populations, as it points to the information different people need and the different opportunities individuals and groups have to act on that information. Further, by understanding how climate information intersects with livelihoods decision-making, we can build rigorous interpretations of the role climate information plays in observed changes in the decisions and outcomes among users of a CIS.

There is, however, currently a gap in the development and testing of methodologies that support such in depth and contextual investigations of the social and economic factors that circumscribe user needs and their ability to utilize available information at the community and household level. This qualitative study of two villages in Senegal is one of several piloted within the Climate Information Services Research Initiative (CISRI) to improve the evaluation of climate services and their impacts by testing innovative evaluation methodologies within ongoing programs. In this case, we test the utility of the Livelihoods as Intimate Government (LIG) approach, an ethnographic approach to livelihoods decision-making, for gathering information about these pathways of impact.

This report has three goals:

- 1) **Develop empirical information about the connection between a specific climate service and the livelihoods decision-making of its users.** HURDL worked in two communities in the region where the Multidisciplinary Working Group (MWG) model CIS in Senegal is being implemented, but which have not yet participated in the program. The MWG model delivers seasonal, 10-day, and daily forecasts (issued twice daily), as well as warnings of extreme events made a few hours before an event.
- 2) **Provide general lessons from the use of a qualitative tool for the monitoring and evaluation (M&E) of CIS.** Specifically, identify lessons regarding the identification of potential



and realized pathways through which CIS might have impact on the lives and livelihoods of their users.

- 3) **Fill knowledge gaps identified in the CISRI learning agendas.** CISRI has compiled learning agendas on the monitoring and evaluation of climate information services<sup>1</sup> and on the identification of CIS users and their needs<sup>2</sup>. These two learning agendas identify gaps in our knowledge around CIS, and seek to organize and prioritize these gaps to guide future research into the design, implementation, and efficacy of CIS. As a third goal, this study responds to some of the gaps raised in these two learning agendas.

## Methods and Approach

To achieve these goals, we employed the Livelihoods as Intimate Government (LIG) framework to understand how farmers across a single FEWSNET livelihoods zone in Senegal (Livelihoods Zone SN10) made livelihoods decisions. LIG is a qualitative approach that involves semi-structured interviews and ethnographic observation. The approach goes beyond the description of activities and assets to develop context-specific explanations of the underlying structure of decision-making which then produces observed outcomes. This explanation is critical for the design, monitoring, and evaluation of climate services, as it presents an opportunity to understand how climate information intersects with the decisions of different users.

## Goal 1: The MWG model: Current awareness, uptake and use, and future pathways of change

The bulk of this report provides insights into how different community members in SN10 currently experience and prioritize vulnerabilities associated with their livelihoods and consequently make livelihood decisions. By laying out the existing logic of livelihoods decision making in this zone prior to full implementation of the MWG model, the report provides a behavioral baseline against which to measure future changes in the logics of livelihoods decision making that might result from engagement with the MWG model. This will be crucial for interpreting observed changes in the material aspects of people's livelihoods in a manner that rigorously considers the pathways through which the climate information could have produced the observed changes. In the report, we also lay out likely pathways of change in material (such as yield) and social (such as changes in gender roles) outcomes that should be monitored for project impact going forward, and how to interpret observed changes.

Further, the report employs this baseline of decision-making to identify opportunities for impact presented by formal forecasts for this livelihoods zone. For example, we expect that if the MWG is effective those men who generally produce surpluses in this zone will see early increases in peanut yield, and later sorghum and perhaps millet. The women in these households will likely focus on increasing cowpea yield. On the other hand, the impact of the MWG on those who have yields that allow for a stable subsistence but less reliable surplus might not be captured as readily through yield

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<sup>1</sup> The learning agenda on monitoring and evaluation of CIS can be accessed at: [https://www.climatelinks.org/sites/default/files/asset/document/2017\\_CVaughan-et-al\\_EVALUATING%20AGRICULTURAL%20WEATHER%20AND%20CLIMATE%20SERVICES%20IN%20AFRICA.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2017_CVaughan-et-al_EVALUATING%20AGRICULTURAL%20WEATHER%20AND%20CLIMATE%20SERVICES%20IN%20AFRICA.pdf)

<sup>2</sup> The paper on identification of CIS users and their needs can be accessed at: [https://www.climatelinks.org/sites/default/files/asset/document/2017\\_Carr-et-al\\_Identifying-CIS-Users-and-their-Needs-Sub-Saharan-Africa.pdf](https://www.climatelinks.org/sites/default/files/asset/document/2017_Carr-et-al_Identifying-CIS-Users-and-their-Needs-Sub-Saharan-Africa.pdf)

increases as through avoided losses during challenging seasons. This baseline is presented in Sections 4-8, and the implications of this baseline for the uptake of the MWG model CIS are laid out in Section 9.

Finally, the report also lays out the appropriate stratification of the population for future monitoring and evaluation of CIS interventions in SN10 (see Section 4). The agriculturalist population of this zone generally falls into households or concessions with one of three livelihoods profiles: Surplus Production Livelihoods, Stable Subsistence Livelihoods, and Low Resource Livelihoods.

## **Goal 2: Lessons about the monitoring and evaluation of weather and climate services from the use of LIG**

The use of the LIG approach in this assessment presents several lessons regarding the use of this tool, and other in-depth qualitative approaches to M&E. The report demonstrates that understanding local decision-making and the use of CIS should begin with the stratification of the user population by locally-identified differences in perceived vulnerability, assets, and livelihoods activities. Aggregating data on uptake and use of CIS at the community-level obscures critical differences in vulnerability across community members and within households. Failure to properly stratify the populations of each livelihoods zone, therefore, is likely to overlook segments of the population that are using the information, as well as those who may have access to the information but cannot use it. Also important is that there are almost always intra-group differences in vulnerability and need for weather and climate information. Therefore, each identified vulnerability group should be stratified by the social cleavages (gender, seniority, ethnicity and so forth) that determine the roles and responsibilities of individuals vis a vis activities shaped by climate information. This is especially critical in contexts like Senegal, where different roles and responsibilities can result in significantly varied vulnerability and livelihood profiles, even within households.

The rigorous interpretation of changes associated with a CIS requires understanding the underlying decisions that produced those changes. Identifying impact requires more than the measurement of yields or incomes. The rigorous interpretation of such outcomes, and the connection of these outcomes with different parts of a user population, are central to understanding if and how a CIS works. This is particularly critical for CIS, as different groups, or even the same individual, may use the information to different ends depending on seasonal conditions or social goals (for instance the same household may seek to boost yields in a good year, while avoiding losses in a challenging year). This report demonstrates that qualitative approaches to M&E are an effective means of understanding the decisions that underlie observed behaviors and outcomes associated with CIS interventions.

The report shows that data on livelihoods decision-making can be gathered in a representative community and reliably scaled to the level of the livelihoods zone. As seen in this study, most observed variations across SN10 are the product of local circumstances that shape the outcomes of decisions, rather than variations in the broad structure of decision-making itself. At the same time, CISRI-related work in Rwanda shows that understandings of decision-making associated with one livelihoods zone often do not apply to other livelihoods zones.

### Goal 3: Filling Gaps in the CISRI Learning Agendas

The report provides preliminary evidence that speaks to some of the questions that emerged from the two CISRI learning agendas: One on the monitoring and evaluation of climate information services and one on the identification of CIS users and their needs

- a) *Over what spatial region or social groupings can a particular CIS be scaled? What factors affect that?*

This study suggests that the broad structure of livelihoods decision making is coherent at the scale of the livelihoods zone, even one in which conditions vary significantly. This suggests that climate information can be tailored to the decisions residents of this zone make, and the basis on which they make them. However, such tailoring must take into account differences in behavior and decision-making within different vulnerability groups in this livelihood zone, as climate information is not likely to have the same utility or uptake across different vulnerability groups within a community, or even within vulnerability groups, without some degree of tailoring.

- b) *What are the broad lessons we might learn about the social constraints to the use of climate information?*

The LIG analysis in this report identifies a range of social constraints in the use of climate information. For instance, women's roles and responsibilities in SN10 effectively preclude them from focusing their livelihoods on the cultivation of rainfed grains, and they have little say in the decisions around such production on household or family fields. The practice of privileging men's agricultural production over that of women delays decision-making for women forcing them to select certain crops and varieties that fit a shorter growing season than that of men. Therefore, information aimed at improving practices around the cultivation of rainfed grains is not likely to be taken up by women in this zone without significant, broader efforts to facilitate transformation in gender roles.

- c) *What are the differences in information gleaned through different methods, and how might different approaches be integrated to draw on strengths and eliminate gaps?" and "What are the most effective means of learning about users and needs in a given place?"*

While this study is purely qualitative, and largely ethnographic in its approach, it serves to highlight the sorts of information that such work can provide to our understanding of CIS users and needs. The ethnographic information in this report explains patterns of behavior in great depth. This information can be used to nuance, augment, and expand on information generated through other methodologies such as surveys. While surveys are useful tools for gathering large numbers of observations about outcomes, they are less useful for interrogating the pathways through which interventions produce those outcomes. Qualitative information focused on livelihoods decision-making explains patterns, comes with a high degree of internal validity, and appears to have significant external validity at the scale of the livelihoods zone.

- d) *How do we identify and potentially measure a broader range of impacts than yield alone?*

This study helps deepen the ways in which we *interpret existing data on the impact and outcomes* of CIS. It clearly defines who the users of the MWG project are, what their needs for weather and climate information are, and what sorts of impacts might be produced by the delivery of credible, salient information. For example, in Zone SN10 we demonstrate that desired yield outcomes can vary significantly depending on whether households are secure or insecure. Secure households are more

likely to seek to increase yields while insecure households make decisions to guard against the loss of yields and maintaining subsistence.

## Summary

Taking a detailed, qualitative approach to the livelihoods of prospective climate service users serves to better understand who these users are, what their needs are, and how CIS can fill some of these needs. Further, this approach clearly identifies the most likely pathways through which a CIS might address user needs. This information facilitates the design of impact assessments that measure relevant indicators of impact and whose interpretations are informed by empirical evidence. Taken together, this approach shows potential for designing effective CIS, and monitoring and evaluating such CIS to maximize learning, such that weather and climate information might live up to their potential as tools for development and adaptation. The report sets the foundation for further activities that can help build capacity of local and national organizations for more effective, efficient and equitable provision of climate information and services for large numbers of poor and vulnerable farmers in Africa.

# 1. INTRODUCTION

This study is one of several piloted within the Climate Information Service Research Initiative (CISRI) to improve the evaluation of climate services and their impacts. This qualitative study of two villages in Senegal's Livelihood Zone 10: Rainfed Groundnut and Cereals<sup>3</sup>, assesses the potential impact and uptake of climate information services delivered by the Multidisciplinary Working Group (MWG) project in Senegal. This project, aimed at addressing the impacts of climate change on rural agrarian livelihoods in Senegal, has been under development and pilot delivery in Kaffrine since 2011 (Lo & Dieng 2015). It was extended to Bambey, Louga, and Thiès Regions in 2013, and Niakhar Region in 2014. Since its initial pilot phase, the project received guidance on identifying users and their needs (Carr, Fleming, et al. 2015; Carr, Fleming, et al. 2016) and, more recently, the CGIAR Program on Climate Change, Agriculture, and Food Security (CCAFS) conducted an impact assessment (Lo & Dieng 2015).

The aim of this study is twofold. First, it provides qualitative data that furthers our knowledge of the uptake and potential impact of the CIS information provided by the MWG by understanding how it fits into the underlying logic of livelihoods for those residing in Ngetou Malick and Panal, two villages in Zone 10. This involves understanding:

- 1) the range of stressors and shocks that impact people's lives as they seek to orient their material and social world towards dynamic and sometimes conflicting goals, who is vulnerable to what stresses and shocks, and what makes particular groups of people vulnerable to particular stresses and shocks;
- 2) how these stressors and shocks orient people's priorities; and
- 3) the ways in which people mobilize resources and use varying strategies (including the use of CIS in decision making) to address these priorities.

This is critical to establish the pathways through which information does, or might in the future, impact farmer decision-making and livelihoods outcomes. In addition, it provides a qualitative dataset that will be synthesized with survey data, collected by CISRI partners as part of an outcome evaluation of the MWG efforts in Senegal. The synthesis of qualitative and quantitative data will enable a meaningful impact evaluation of climate information engagement and uptake, a critical first step toward the evaluation of the wider livelihoods impacts of this project. Specifically, this synthetic effort is aimed at addressing survey methodology limitations with regard to the internal validity of data interpretation, and the limitations of ethnographic methods with regard to external validity.

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<sup>3</sup> Zone SN10 is specific to Senegal. The Famine Early Warning System Network (FEWS-NET), whose livelihoods zones we employed in this study, does not create cross-country zones. For example, Zone 10 in Senegal is distinct from Zone 10 in Mali, or any other FEWS-NET country. This study is therefore generalizable to a livelihoods zone in Senegal, but should not be assumed to be valid for any other livelihoods zone in Senegal or in another FEWS-NET country.

## 2. CIS PROJECT CONTEXT: THE MULTIDISCIPLINARY WORKING GROUP MODEL IN SENEGAL

MWG advice has three main objectives: (i) help farmers to master their farming calendar, (ii) assist farmers in choosing dates for cropping operations, (iii) secure people and property. The advice focuses on high winds, rain, thunderstorms and lightning” (Lo & Dieng 2015). To achieve these goals, the MWG model operates at two scales. At the national scale, the MWG is composed of representatives of the Department of Agriculture (DA), the Institute of Agricultural Research of Senegal (ISRA), the Ecological Monitoring Center (CSE), the National Agricultural and Rural Council Agency (ANCAR), the National Agricultural Insurance Company of Senegal (CNAAS), and the National Agency of Civil Aviation and Meteorology (ANACIM). This group produces climate information, interprets it into actionable decisions, and communicates these products to users at the local level (Lo & Dieng 2015). At the local scale, MWGs consist of Senegal’s decentralized technical services, farmers and local farmer organizations, local administrative authorities, NGOs, and the media. Local MWGs are responsible for collecting climate information from ANACIM, disseminating that information to farmers, monitoring harvests and potential agricultural shocks and stressors, and manage early warning systems that use the climate information produced by ANACIM (Lo & Dieng 2015). ANACIM works with CCAFS to produce four types of CIS: seasonal forecasts on the amount of rainfall, onset and cessation; 10-day forecasts, 2-3 days forecasts and instant forecasts for extreme events. Seasonal forecasts are generally characterized as rainy, normal, or deficit, and are updated monthly throughout the agricultural season (June, July, and August). The 10-day forecasts are intended to help identify dry spells and other shorter-term events that might challenge agricultural production. Daily reports are delivered twice per day, and early warnings are used to warn of events such as thunderstorms, which can cause significant damage to cattle holdings.

A previous assessment of this project (Lo & Dieng 2015) claimed several impacts. First, that farmers in the project area saw the climate information provided by the MWG as a source of support for their agricultural activities. Second, that farmers considered the MWG information about the date of the start of the rainy season and the seasonal forecasts were considered the most important. Third, that farmers had shifted from a position of skepticism to one of demand for this climate information. Fourth, farmers shifted a number of practices, from their selection of varieties to the timing of their millet sowing to their day-to-day application of fertilizers, in response to this information. Fifth, farmers started using seasonal forecasts to assess their financial needs for the upcoming season and appropriately calibrate their loan sizes. Finally, they reported that farmers using the information saw greater yields than those who were not.

While these findings are promising, their claims of impact are difficult to assess because they rest on assumptions about the users of this information, and those users’ needs, that do not align with the situation on the ground in Livelihoods Zone SN10. First, the evaluation assumes that “the availability of information is a response to climate risk management,” which implies that this program is demand-driven. This is perhaps the least problematic of the assumptions, but it is one of importance and deserves assessment. The field of climate services has a long history of supply-driven services, where climate information about various trends, shocks, and stressors became available and was disseminated under the assumption that it was inherently useful to users, either assumed or explicitly targeted (Hansen et al. 2009; Carr & Owusu-Daaku 2016; Carr & Onzere 2018; Roncoli 2006; Millner & Washington 2011; Shankar et al. 2011). There has been significant pivot away from this approach in climate services as the field recognized that vulnerability to climate-

related shocks and stressors was not only a function of exposure, but also the sensitivity of people and activities to that shock/stressor and their capacity to adapt to it. Thus, the design of the MWG model, which is intended to create locally-tailored advisories that speak to specific needs, is a model of climate service production that seeks to identify information needed to more comprehensively and effectively assess the vulnerability of potential users, as opposed to climate services framed around risks perceived by climate scientists and other actors from outside the user context.

The second assumption, “behavioral change as a result of application of the agricultural advice has helped to improve agricultural productivity,” is tremendously problematic in the context of an impact evaluation. This assumption effectively starts the evaluation from the assumption that the intervention works, in terms of uptake, utility, changes in behavior, and beneficial changes in outcomes from those changes in behavior. All of these cannot be assumed in an impact evaluation, but must be assessed. As we demonstrate below, this assumption is not valid in Zone 10, where the capacity to take up such information, and indeed the potential utility of the information, varies greatly. The third assumption, that “a multidisciplinary approach...is essential for improving the resilience of the farming system” is effectively untested up to this point, as even if the impact of this project had been accurately and appropriately measured, there is no counterfactual data against which to compare this impact. All of the data in the impact evaluation were gathered in a short period during a single growing season, and therefore cannot capture the different ways in which farmer outcomes might have changed under different seasonal conditions.

In this report, we unpack the second assumption of the previous impact assessment, “behavioral change as a result of application of the agricultural advice has helped to improve agricultural productivity.” Specifically, we examine who makes agricultural and wider livelihoods decisions, and on what basis. This is important because, in the prior assessment, all farmers were conflated and treated as a unitary category, without regard for identity (particularly gender) or their relative asset holdings, two factors that were previously identified as critical to shaping individual and household livelihoods decision-making (Carr, Fleming, et al. 2015; Carr, Fleming, et al. 2016) and therefore climate information uptake and use. This appears to be at least partially a product of the methods employed in this impact assessment, which included only limited engagement with farmers via interviews. In fairness to the implementers of the impact assessment, they were limited by time and funding, and acknowledged that a “questionnaire-based interview would have allowed for not only better quantification of the results (production with or without CI, number of persons applying the advice given, etc.) but also an approach by category of stakeholders, including gender (big, small farmers, women farmers, etc.)” (Lo & Dieng 2015). However, this issue with methodology and data, along with existing understandings of livelihoods in this zone (Carr, Fleming, et al. 2015; Carr, Fleming, et al. 2016; Kaag 1996; Perry 2005; Venema 1978), suggests that the claims of uptake, use, and impact reported in this assessment are at best constrained to a subset of the residents of this zone, and therefore do not represent the actual impact of this project on the wider agrarian population. Further, the claims of impact obscure opportunities to expand or modify the project to better meet a wider set of needs in this zone, and indeed in the wider area in which the project is being implemented.

Understanding the impact of climate information on rural livelihoods requires first understanding who is receiving and using that information, and for what. Assessing the existing impact of this information, versus its potential impact (should it reach a wider audience, or provide different, more relevant information) requires understanding how people live in this livelihoods zone, a broad question that engages everything from the activities they undertake to local understandings of

identity categories and their associated roles and responsibilities (Carr 2013). In this report, HURDL first unpacks the latter question of how people live in this zone to identify groups of potential climate service users and their specific information needs. It then turns to the question of the use of existing information to assess current patterns of use, identifying the specific pathways through which climate information becomes an input to agricultural strategy and agrarian livelihoods more broadly. It is not possible to design an effective or accurate impact evaluation of the MWG project in Senegal until we understand who the users of this information are, and for what they use that information. This report provides that information, and thus creates the foundation for the design of an effective, accurate impact assessment of the MWG model that not only speaks to its existing impact, but provides opportunities for learning that will improve this project's impacts and those of future projects that seek to build on its lessons.

This report also speaks to the CISRI learning agenda on 'Identifying CIS Users and their Needs' (Carr et al. 2017). This learning agenda raises a set of questions with regard to how we might best identify users and their needs. Some of these questions are informed by this report. For example, this report speaks to question 1.1 from that agenda, *how often does bias obscure users and needs?*, by laying out the project assumptions evident in CGIAR documentation and the impact assessment, and comparing these to findings from extended ethnographic fieldwork in the project area. In so doing, this report identifies how assumptions about the users of this information shaped who was targeted, and what information promoted, versus the situation of users and needs on the ground. It also informs question 4.2, *what are the most effective means of learning about users and needs?*, by employing ethnographic methods to this question. The claim here is not that ethnographic tools are inherently better or more appropriate for such identification, but that these tools allow us to see things about users and needs that are not visible via surveys or other tools. Thus, the data in this report opens a question about what information we need to better design and implement climate services for agriculture, and what tools are best suited to the collection of that information. Third, this report speaks to question 4.4, *what are the broad lessons we might learn about the social constraints to the use of climate information?*, by focusing on the social dynamics that shape observed livelihoods decisions and outcomes in this project context. Finally, this report is part of a larger effort framed around this project in Senegal and another CIS in Rwanda that integrates large-sample quantitative datasets on CIS users, needs, and outcomes with ethnographic data on the decisions and factors that produced the outcomes observed in the surveys. This wider effort informs question 2.1, *What are the differences in information gleaned through different methods, and how might different approaches be integrated to draw on strengths and eliminate gaps?* That question is taken up in a separate report.

### 3. METHODOLOGY

HURDL employs the Livelihoods as Intimate Government (LIG) approach as the conceptual framework ordering its field methods and analysis (Carr 2013; Carr 2014). Livelihoods approaches have long held an important place in development efforts to understand what people are doing in particular places, and the implications of those activities for the environment and economy. However, most such approaches are broadly descriptive, ordering observed assets, activities, and decisions into frameworks and flows without an explicit theorization of how decisions are made. LIG rests on just such an explicit theorization (Carr 2013), and therefore is a means of understanding the decisions behind observed livelihoods decisions and outcomes. It views livelihoods as ways of living in particular places - not merely the activities pursued by individuals. Decisions people make to engage in various livelihood strategies are efforts to govern their world by reconciling social, material and cultural contexts so as to achieve various, often shifting goals. For



instance, HURDL livelihoods studies across southern Mali (e.g. Carr, Onzere, et al. 2015; Carr, Onzere, et al. 2016) found that men grew millet because the crop is suited to local agroecological conditions. However, growing enough millet to feed the household for the entire year (instead of acquiring it through the market) was also a social marker of a man's success as the head of household. Thus, men faced both social and cultural pressures to grow the crop and would be likely to keep growing it even in unsuitable conditions. LIG therefore incorporates a much wider range of stressors, including economic, environmental and social stressors inherent to local social roles and responsibilities, into explanations of people's goals, decisions, and actions than seen other under livelihoods approaches. This broader lens is critical to fully understanding why people do what they do, and how development interventions such as CIS might speak to those logics of livelihoods.

At its broadest, LIG sees livelihoods decisions as taking shape at the intersection of three domains of everyday life: discourses of livelihoods, mobilization of identity, and tools of coercion (see Figure 3.1). *Discourses of livelihoods* are the ways people talk about and understand how they should live in a particular place, especially as related to what activities they should undertake, to what ends those activities should be directed, and who should be undertaking them. Insofar as discourses of livelihoods reference who should be doing what, they mobilize particular aspects of individual identity, elevating particular roles and responsibilities that shape how people see themselves, and how they understand appropriate ways of living in that place. *Identity* refers to the ways in which communities conceptualize the ideal community and household members. These conceptualizations directly translate into the roles and responsibilities different men and women must fulfill within the household and community, and the resources that individuals can access to fulfill these responsibilities. In pursuing different livelihood activities, existing discourses of livelihoods and identities are reinforced and reproduced. However, livelihood strategies produce inequitable outcomes for community and household members and can lead to frustration and discord. Individuals are likely to challenge existing livelihood logics as they seek to improve their positions. Additionally, the physical, environmental and social contexts in which people are embedded are complex and change often, challenging the legitimacy of livelihood logics as the context exceeds their utility (for instance, as during a period of civil unrest that significantly changes social norms). Therefore, it is important to understand how communities manage potential deviations from expected roles and responsibilities by employing various *tools of coercion*, locally legitimate means of disciplining transgressions of local expectations or rewarding those who conform to expected roles and responsibilities (Carr 2013; Carr 2014). As individuals strive to meet their roles and responsibilities in everyday life, these three conceptual areas intersect in myriad ways they create locally-specific 'social facts' which define, bound and set possible courses of action, and consequently observed livelihood outcomes (Carr 2013).

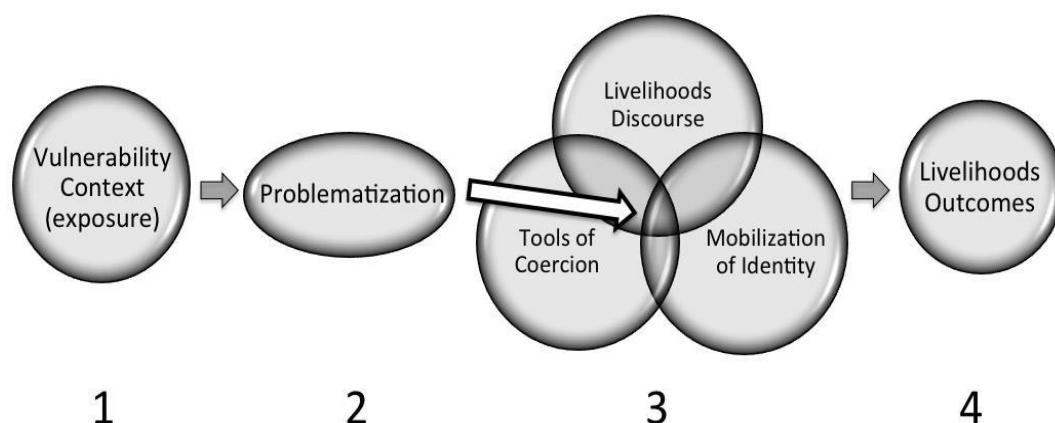


Figure 3.1: Conceptual diagram of the LIG approach (Carr 2014).

The diagram outlines that in 1) identifying current stressors to well-being and livelihoods (the vulnerability context); 2) moments where particular stressors become identified as problems for one group of people but not for another, the logic and legitimacy of livelihood strategies are called into question (problematization); 3) This, in turn, provides a point of entry into understanding how livelihoods decision making emerges at the intersection of the mobilization of identity, livelihoods discourses and tools of coercion 4) and forms the basis for interpreting livelihoods strategies and outcomes (Carr 2014).

### 3.1. Criteria for Site Selection

The data in this report was gathered in two communities in Zone SN10 (Figure 3.2). HURDL examined the livelihoods of Ngetou Malick in 2013 as part of an assessment of the potential users for climate information in Senegal's Kaffrine region (Carr, Fleming, et al. 2015). Ngetou Malick was selected for its proximity and demographic/livelihoods similarities to other communities that had been engaged in the early stages of the MWG project in the Kaffrine commune of this region. Ngetou Malick is located approximately 9km from Kaffrine, the regional capital, along a well-maintained dirt road. It is now in the middle of a range of communities that have been directly engaged by the MWG, which helps them interpret the climate information delivered by radio. Panal is located in the Guinguineo commune, where there is no MWG but residents can still hear the climate information broadcast via radio. It is approximately 40km north and west of Ngetou Malick, and 45km to the northeast of Kaolack on the border of Livelihoods Zone NS08: Rainfed Groundnut and Millet. It was selected by CISRI partner ICRAF as a comparative site for its biophysical similarities to the communities in the Kaffrine commune who have been engaged by the MWG. It is divided into 6 different quarters, and the HURDL team stayed in or visited each of them during its fieldwork, conducting interviews in each: Panal Gueyene (3 interviews), Panal Ndiaré (23 interviews), Panal Peulh (6 interviews), Panal Serrère (16 interviews), Panal Thiarane (15 interviews), Panal (22 interviews). According to residents of the village, Panal Thiarene is the largest quarter of the greater Panal village (PT061). Panal is much further from urban areas and has much weaker transportation infrastructure than Ngetou Malick. Further, the precipitation gradient in this zone runs from northeast to southwest, with the northeast being the driest. As Panal sits very near the northeastern edge of this zone, this area receives less precipitation (400-500mm per year) than does Ngetou Malick (500-700mm per year) located further south and west toward the middle of the zone. Therefore, Panal and Ngetou Malick present a contrast of situations within the same

livelihoods zone, an opportunity to assess the degree to which the structure of livelihoods decision-making varies within a given zone.

### 3.2. Data collection

In Ngetou Malick, all fieldwork was conducted between May and July, 2013. This fieldwork produced interviews with 44 residents, of the community (21 women and 23 men) and observational data about their activities. In Panal, fieldwork was conducted between January and April, 2017. This fieldwork resulted in interviews with 85 residents (37 women and 48 men) and observational data about their activities. Following the LIG approach, in each village we collected data in two phases. Both phases used individual in-depth qualitative interviews and participant observation conducted by the field team. During the first phase of data collection, the field teams focused on eliciting an overview of stressors and shocks people face, their livelihood activities, and why they undertook these livelihood activities. In the second phase of data collection the team sought to understand which roles and responsibilities are associated with particular community members, how community members are expected to meet these responsibilities, and the consequences faced by those who do not live up to their roles and responsibilities.

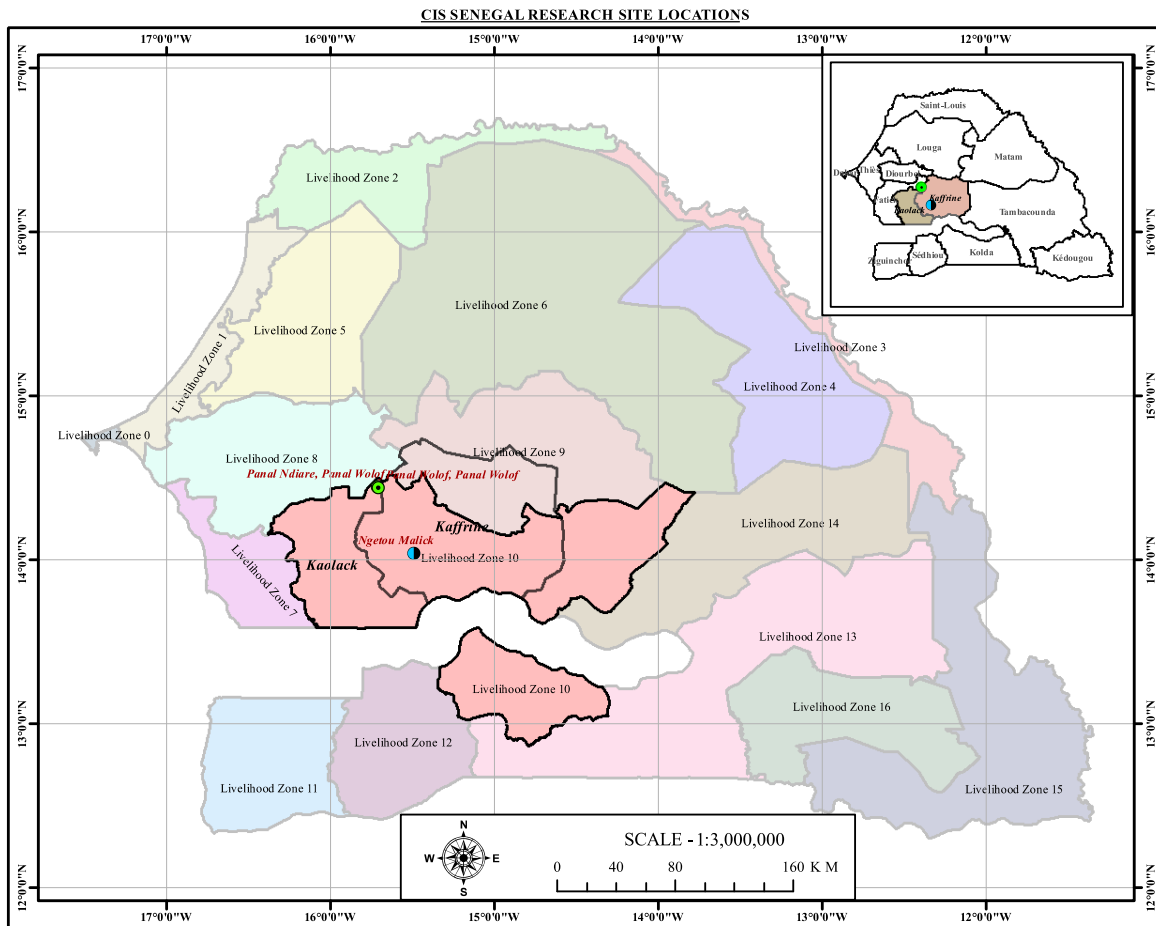


Figure 3.2: Locator map of Livelihoods Zone 10, and the villages of Ngetou Malick and Panal.

### 3.3. Data Analysis

Under LIG, communities are stratified by the assemblages of vulnerability reported by its members. Though they may live in the same place, and participate in broadly similar livelihoods activities, different members of the community have different exposures to shocks and stressors, different sensitivities to these issues, and different adaptive capacities through which they might address their challenges. Within communities, groups of people share assemblages of vulnerability, similar experiences of the vulnerability context and similar access to resources that can be used to address stressors and shocks. The groups that coalesce around these assemblages, or vulnerability groups, are the primary analytic units for LIG.

The LIG analysis undertaken for this project involved a number of steps as summarized below.

#### 3.3.1. Translation

The field team employed a qualitative interview guide to structure data collection. The conversations with community members that this guide structured were recorded in handwritten notes. Interviews were conducted in Wolof, with French translators. The French interview notes were then translated to English by members of the field team and translators hired by HURDL to facilitate the rapid coding and analysis of the interview data.

#### 3.3.2. Coding

Translated interviews were entered them into a qualitative data analysis software, MAXQDA. These notes were then coded for critical themes and points, using the LIG approach as a broad initial structure for codes. The Ngetou Malick data was coded in 2014-15 as part of a prior project, and represented one of the first implementations of the LIG approach. This project was revisited, and the coding structure updated, to capture lessons learned from implementations of the approach since then. The coding of the Ngetou Malick data, including updates to the coding system added as part of the analysis for this project in 2018, resulted in 3405 coded segments of text. The coding team for the Panal data generated 16,520 coded segments of text for analysis. The substantially increased number of codes in the Panal data reflects the evolution of the LIG approach over a series of implementations, both in terms of data collected during fieldwork and in terms of the coding of that data.

#### 3.3.3. Establishing the nature of livelihood decision making

In the work on both villages, after the codes were cleaned and refined, data was analyzed for themes and insights related to the logic of livelihoods in the two communities of study as described in the following steps.

##### *a. Establishing the vulnerability context*

The first step in data analysis involved the identification of respondents' stressors and shocks. This enabled us to map out the overall vulnerability context as well as different assemblages of vulnerability. Information on stressors and shocks was triangulated across interviews and with existing literature to establish the validity of claims about shocks and stressors. This, along with a review of field notes and a consideration of the initial groupings from the field team, formed the basis for the final grouping of respondents into assemblages of vulnerability groups.

##### *b. Deepening context-specific understandings of identity*

To establish a deeper understanding of the relationship between the roles and responsibilities identified in the assessment of activities and identity, we relied on data from interviews and observational notes gathered from each village. During this stage of analysis, we sought to explain how and why particular roles and responsibilities were attached to particular people within the household and community

*c. Exploring discourses of livelihoods*

To uncover how community members believed they should live in their community, we explored how they perceived and characterized the livelihood activities in which they were engaged and why they perceived these activities as desirable, appropriate, or inappropriate within the community context. Discourses of livelihoods, when considered in light of the mobilization of identity, potentially explain why and how various community members can use CIS.

*d. Identifying and understanding tools of coercion*

At this stage of the analysis, we examined which individuals within the community had the legitimacy to discipline or reward other community members for their actions and the various ways in which this was carried out. Further, the team sought to understand if there was considerable agreement about these tools and their appropriate use, and to identify contexts in which they were not applied despite clear transgressions of expected roles and responsibilities.

**3.3.4. Checking analysis against reported sub-group vulnerabilities**

The last step in analysis applied the logic of livelihoods identified through the analysis above to the different assemblages of vulnerability identified in the first step. In this step, the team examined the assemblages of vulnerability reported by different members of the same vulnerability group in each community, and applied the logic of livelihoods developed through the steps above to explain the patterns of reported vulnerability. As vulnerability is closely linked to livelihoods (Gaillard 2010), the logic of livelihoods developed through the analysis above should illuminate the reasons why different members of the same vulnerability group report somewhat different assemblages of vulnerability. This exercise allowed the team to check the analytic value of the analysis by establishing the extent to which it explained why different people prioritized different stressors in the community. Further, in understanding who prioritized what stressors and why, this step allowed the team to identify the ways in which different community members can use CIS.

**3.4. Confidence and Confounding Factors in Analysis**

The analysis in this report is subject to uncertainty resulting from both the particularities of data collection and the character of LIG analysis. First, HURDL gathered its data in two distinct field seasons, one in 2013 and one in 2017. This introduces two types of uncertainty into HURDL's analysis, related to different issues of change over time. The first is a question of whether or not the four-year gap between data collection efforts was enough time that activities and decisions have changed in significant ways that are not accounted for in the data. The second is a concern that Hansen has voiced with regard to the evaluation of CIS (get Jim cites), that CIS likely have different values during different sorts of seasons. For example, during a season of average rainfall, farmers might use the climate information to maximize yields, while in a dry season they might seek to avoid losses. These different goals would present very different appearances of impact, and therefore it is important to characterize the 2013 and 2017 seasons such that we identify any differences large enough to affect the overall structure of decision-making. This, in turn, requires a characterization of

HURDL's understanding of decision-making, to identify areas in which it is robust and where it might be susceptible to season-specific events.

LIG is an effort to uncover the decision-making structures that produce observed decisions, actions, and activities. These decision structures do not shift rapidly, because they are comprised of three major parts: discourses of livelihoods (how one lives in a place, including appropriate activities to undertake and how to undertake them), the mobilization of identity (who should undertake those activities and make decisions about how to undertake them), and tools of coercion (locally-legitimate means of compelling individuals to conform to the expectations that emerge from discourses of livelihoods and their mobilization of identity). Agrarian livelihoods are overbuilt for risk and vulnerability, and therefore discourses of livelihoods always incorporate expectations of variability and risk. In a "normal" year (however this might be defined), the memory of previous, challenging years and the likelihood that subsequent years will be challenging is always present. In a challenging year, the memory of and likelihood of a return to normal or favorable years is present. The very questions "what activities should be undertaken?" and "how should they be undertaken?" therefore always incorporate an understanding of and expectation of challenges and opportunities. Variation within historical experience lies within these discourses of livelihoods, not beyond them. Therefore, on a year-to-year basis, these discourses will not shift greatly. In a challenging year, some stressors may figure more prominently (water scarcity, drought, animal morbidity) than in a normal or favorable year (lack of credit to expand production, lack of access to adequate land), but all of these stressors are ever-present, as both challenging and favorable years are ever-present. For this reason, LIG does not weight stressors listed by agrarian populations, for example by the order in which the stressor is mentioned, because agrarian livelihoods work to address a suite of shocks and stressors whose configuration changes year after year. Because these are unweighted, LIG's framing of the vulnerability context, and the use of assemblages of vulnerability to stratify the population, is unlikely to be significantly affected by year-to-year variation in conditions that fall within the boundaries anticipated by discourses of livelihoods.

The mobilization of identity is also unlikely to change year-to-year. While identity is always situational and intersectional, discourses of livelihoods mobilize particular aspects of identity and shape the roles and responsibilities associated with those identities. What these discourses mobilize, however, goes well beyond the immediate household or community, and beyond the current situation. For example, gender roles can extend throughout broad ethnicities, whether they live in a rural community or a large city, and these roles often have deep historical roots to which individuals feel attachment. These broader identities do not shift rapidly. The mobilization of aspects of these already-durable identities by resilient, durable discourses of livelihoods creates a very resilient set of expectations for how to live in particular places that is not easily displaced.

Finally, this intersection of identity and discourses of livelihoods is maintained through various tools of coercion, sanctions for the failure to conform to expectations that range from verbal corrections and warnings to physical violence and even the expulsion from the household or community. The legitimacy of these tools of coercion are drawn from both wider expectations of identity and the fact that livelihoods, as ways of living in a particular place, provide safety and security in the context of a world marked by variability. When individuals undertake unexpected activities, conduct their activities in ways that are new or otherwise surprising, or refuse to play their roles or live up to their expectations, they put not only themselves, but the wider household, and sometimes the wider community, at risk. In such situations, efforts to encourage individuals to comply with these expectations are seen as legitimate, and will continue to be seen as such until discourses of

livelihoods and their mobilization of identity change. Such change does happen, but under normal conditions it does not happen quickly.

While LIG is robust under conditions that fall within the expectations in discourses of livelihoods, no matter how variable, a LIG analysis can be compromised in conditions of extreme stress or change that depart from expected parameters. For example, under an unprecedented, multi-season drought, the physical risk to life or the associated loss of assets or activities could compromise discourses of livelihoods, calling into question the fundamental assumptions about what activities to conduct, and how to conduct them. This, in turn, can lead to questions about who should be conducting those activities. Without clear expectations to enforce, tools of coercion can lose legitimacy, and the structure of livelihoods decision-making could change substantially. Therefore, any LIG analysis is only valid for the expected spread of conditions under which that analysis was conducted. Any data collection across seasons and years must ensure that no such extremes, and associated potential changes, have taken place in the intervening time.

For the analysis at hand, the LIG analysis remains robust because there was no extreme shift in conditions, either in 2013 or 2017, nor did such an event occur in between. Further, there is no evidence of substantial change in politics, economy, or infrastructure to suggest pressures that might be more slowly inducing substantial change in the context across the four years between data collections.

## **4. VULNERABILITY CONTEXT: LIVELIHOODS ZONE SN10: RAINFED GROUNDNUTS AND CEREALS**

According to the most recent FEWSNET livelihoods zone maps (updated in 2015), Livelihoods Zone 10 covers the central, southern part of Senegal directly north of the Gambia (Figure 3.2). Much of Zone SN10 receives between 500 and 700 mm of rain each year, though northern and eastern parts of this zone lie in areas that average between 400 and 500mm per year. This limited amount of rainfall generally falls between May and October, with the majority in July and August. The rest of the year is dry.

The 2011 description of this area fell under Zone 8: Agro-pastoral Peanuts Zone, and has not been updated (FEWSNET 2011). According to this earlier description, farming is the principal livelihoods activity in the area, along with livestock sales, trade, crafts, remittances, salt sales, and horse-drawn transport. The principal staple crops in the region are rice, peanuts, millet, maize, sorghum, and cowpeas. Of these, peanuts, millet, and cowpeas are commonly sold, along with watermelon, hibiscus, cotton, maize, and sesame. Cattle, shoats, donkeys and horses, poultry, and pigs are the dominant domestic animals.

### **4.1. Livelihoods Zone 10: Vulnerability Context**

According to the 2011 description of this zone (FEWSNET 2011), the principle vulnerabilities faced by residents include drought and unseasonal rains, insect pests (including locusts), animal diseases, illness, bush fires, soil and groundwater salinization, floods, land pressure, cattle theft, and unsold stocks. According to FEWS-NET, this area is characterized by production deficits in the north (in this case, Panal), and normal to surplus production levels in the south (Ngetou Malick). To represent the range of vulnerability contexts encompassed in this zone, we begin with Ngetou Malick.

Figure 4.1 represents the stressors and shocks reported by the 44 residents of Ngetou Malick in 2013. These stressors are broadly consistent with the description of this area from FEWS-NET. While the agricultural production stresses are related more to access to equipment and animals than to climate and weather, this is a product of Ngetou Malick's location further south and west in this zone, where there is more precipitation. Second, the stresses around equipment and animals are of two types. Those reporting a lack of equipment and animals had no direct access to these important assets. Those reporting insufficient equipment and animals owned one or both, and sought to expand their production through the acquisition of more of these assets. Finally, the rate of reporting for all stressors is relatively low, with only water-related stresses, principally access to water for irrigation, being reported by more than half of the sample. In this way, the vulnerability context represented in Figure 4.1 is consistent with the FEWS-NET representation of the southern part of this zone as marked, on the whole, by normal to surplus production.

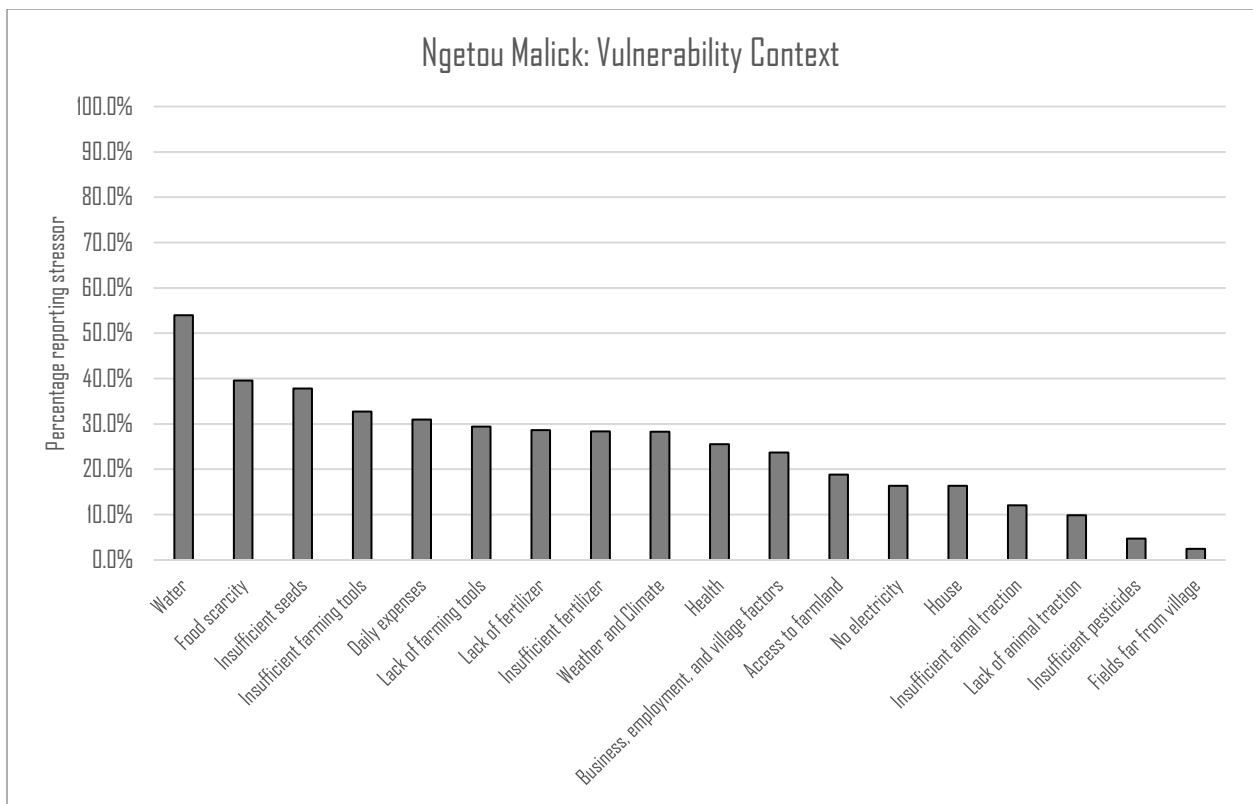


Figure 4.1: The vulnerability context of Ngetou Malick, as reported by residents interviewed for this project

The relatively low rate of reporting for all stressors also suggests that different residents of this village have different experiences of the vulnerability context. During data collection, the field team stratified the community into three groups: those living in households without plows or draught animals, those living in households with draught animals but not plows, and those living in households that owned both plows and draught animals. Looking more broadly at these groups, we found them to be characterized by different mixtures of livelihoods activities, animal ownership, and agricultural strategies (Figure 4.2). To characterize these three groups, we have named them Surplus Production Livelihoods (SPL), Stable Subsistence Livelihoods (SSL), and Low Resource Livelihoods (LRL).



Group	Long Name	Animal Ownership	Agricultural Production	Nonfarm employment/ income
SPL	Surplus Production Livelihoods	<ul style="list-style-type: none"> <li>- Draught animals, often more than one type</li> <li>- Various small animals that can be sold to meet financial needs or address shocks</li> </ul>	<ul style="list-style-type: none"> <li>- Owns plows</li> <li>- Often owns additional equipment (seeder, cart)</li> <li>- Often cultivates millet, maize, and sorghum along with peanuts</li> <li>- Highest rate of gardening</li> </ul>	-Significant engagement in business activities
SSL	Stable Subsistence Livelihoods	<ul style="list-style-type: none"> <li>- Draught animals, usually only one type, and often only one animal</li> <li>- One other type of animal, often poultry but sometimes goats and sheep</li> </ul>	<ul style="list-style-type: none"> <li>- Must borrow or rent plows and other equipment</li> <li>- Cultivates millet, maize, and some cowpeas along with peanuts</li> <li>- Minimal gardening</li> </ul>	- Some business engagement
LRL	Low Resource Livelihoods	<ul style="list-style-type: none"> <li>- Limited animal ownership</li> <li>- No draught animals</li> <li>- Very limited animal types beyond poultry</li> </ul>	<ul style="list-style-type: none"> <li>- Must borrow plows and other equipment</li> <li>- Cultivates peanuts, cowpeas, and hibiscus, with little maize or millet production</li> </ul>	- Business engagement similar to other groups, reports of work as agricultural laborers

Figure 4.2: Overview of vulnerability groups in Ngetou Malick

Figure 4.3 shows the different assemblages of vulnerability associated with these groups. Aspects of these assemblages are unsurprising. Those with SPL are not concerned with a lack of draught animals or farm equipment, but express high rates of concern for insufficient equipment and fertilizer as this limits their ability to expand their production. Interestingly, they also express the highest rates of concern for water stress, food scarcity, and health issues. Those with LRL express the highest rates of concern for lack of equipment, lack of animal traction, and monetary stress. However, they also express the lowest rates of concern for water stress, food scarcity, and insufficient fertilizer. Finally, between these two groups are those with SSL, who express the same rate of concern for lack of tools and insufficient tools, reference concerns for both lack of traction and insufficient traction, and have the highest rates of concern for business and employment stresses. While there are important differences among the assemblages of vulnerability of these groups, differences that we explain below, overall the picture of Ngetou Malick is one of a community that is not facing existential crises in its livelihoods. Even those with LRL are not reporting high rates of stress across the vulnerability context, while those with SPL and SSL are producing surpluses with their agricultural efforts on a regular basis.

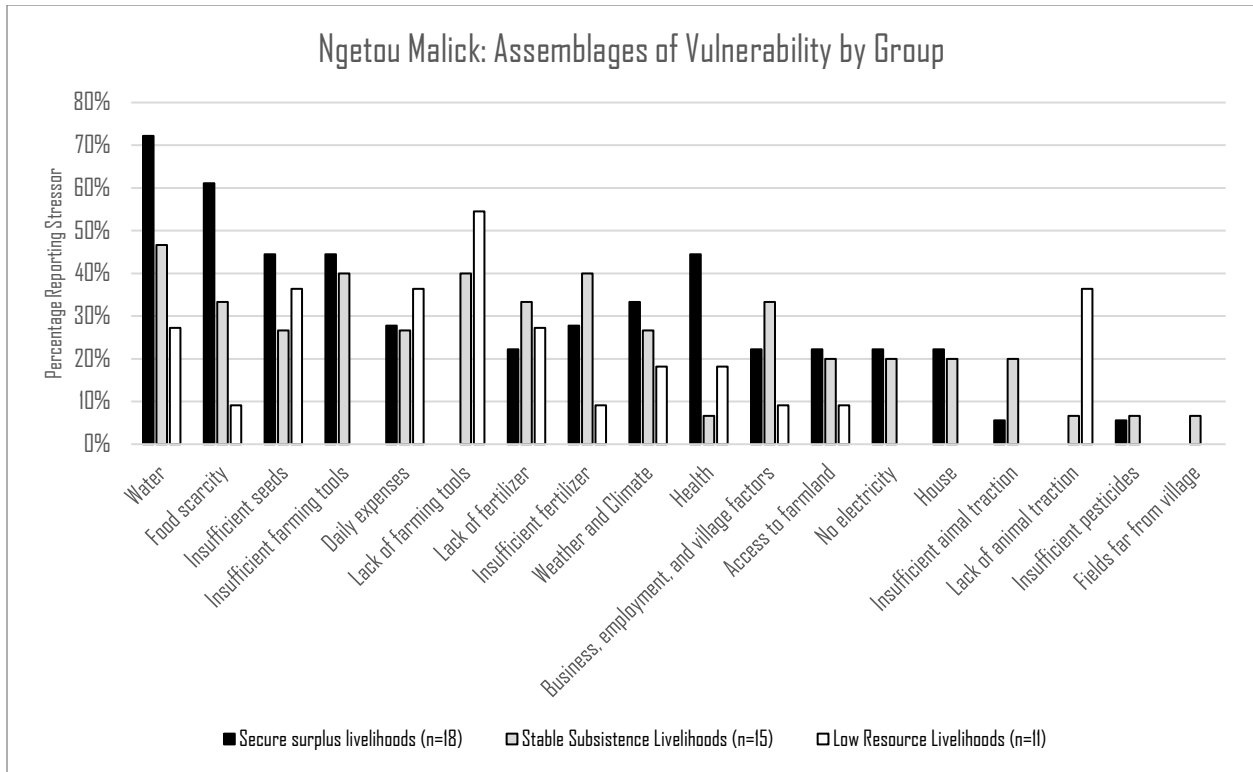


Figure 4.3: A comparison of the assemblages of vulnerability reported by members of each group in Ngetou Malick

The village of Panal has limited market access with no markets in any of its immediate quarters. Many residents in Panal report having to travel 7.5 km east to the village of Gnibi for market access. As satellite images of the area show, residents of Panal also face limited water access. Some residents complain about the overall lack of water and/or the high price of getting access to water. This further limits the ability of residents to begin or expand gardening activities. Located further north, and much further from urban settlements, than Ngetou Malick, the vulnerability context of Panal reflects different, and somewhat more intense pressures. It is telling that a senior man in Panal noted that its name means “asking for help” in Wolof (PW007).

Figure 4.4 lays out the stressors identified by the 85 residents of Panal who were interviewed for this project. Most notable is the rate of reporting stressors, with three (daily expenses, insufficient seeds, and food shortage) reported by more than half of the respondents. At the same time, some of the most highly reported stressors in this village are those associated with relatively secure farmers seeking to expand production: insufficient farmland, insufficient seeds, and insufficient equipment. Lack of equipment and seeds, while also commonly-reported stressors, are reported less frequently than those associated with stable, secure livelihoods. Further, fewer than 10% of those interviewed in Panal reported either insufficient or lack of draught animals as a challenge.

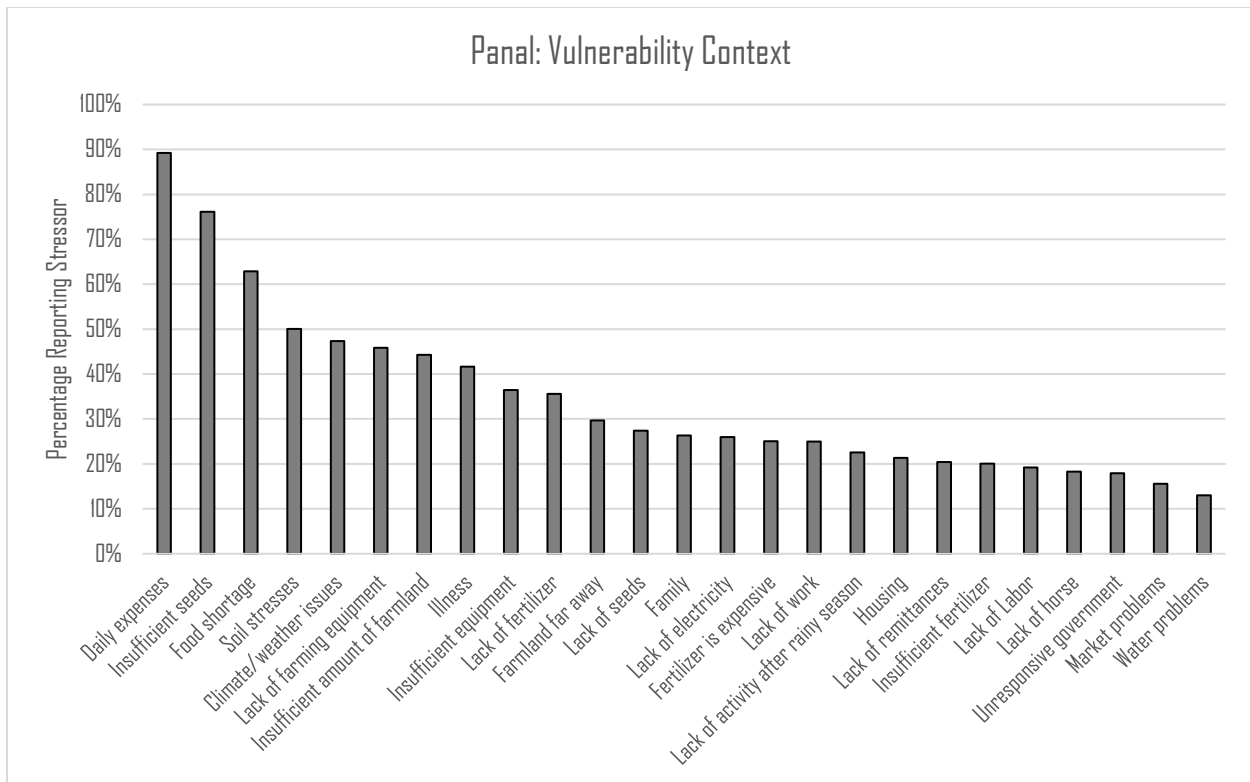


Figure 4.4: The vulnerability context of Panal, as reported by residents interviewed for this project

As in Ngetou Malick, the residents of Panal have varying experiences of their vulnerability context. During fieldwork, the team identified eight groups in Panal that were perceived to have distinct assemblages of vulnerability. When the data was analyzed in HURDL and the assemblages of vulnerability for each of the eight groups were compared, we identified several groups that shared an assemblage of vulnerability and condensed this initial list to three groups. While the vulnerability analysis of Panal was conducted independently of that for Ngetou Malick, the three groups identified for Panal share the same characteristics as those in Ngetou Malick, suggesting a consistent stratification of the population across this livelihoods zone.

The assemblages of vulnerability associated with the groups in Panal are, on one hand, broadly similar. However, they highlight several key differences among these groups and their experiences of the vulnerability context. Those with Surplus Producing Livelihoods (SPL) lead in the reporting of stressors that limit their ability to expand their production, such as inadequate equipment and fertilizer. They are also the most concerned about weather and climate issues. As this group does not suffer from a lack of basic agricultural assets, the quality of the agricultural season takes on greater importance with regard to their perceived success than in other groups where access to basic agricultural needs is in question. Similarly, this group reports the highest rate of concern for the lack of electricity in the community, principally because this group is the one most able to pay for such service if it was available. On the surface, the relatively high rate of concern for food shortage in this group appears to contradict the notion that these individuals are able to securely generate agricultural surpluses. However, when one examines what members of this group mean when they say food shortage, it becomes clear that this is not an existential stressor, but a seasonal issue that arises when their previous production does not last all the way to the new harvest. Members of this group are able to access loans or other forms of employment to gain access to needed food.

However, taking loans results in repayments that compromise their ability to dedicate their surplus production to investment in their farms. Further, taking nonfarm employment to earn money limits agricultural production. For example, one junior man (PW05) reported that such food shortages forced him to seek out nonfarm employment, but in taking up these jobs he had to leave his farm “for a short time.” While short, this absence delays his agricultural work, which then impacts his yields. Thus, the reporting of this stressor, as well as stresses around household expenses, among this group is more a reflection of their overarching concern for increasing their yields and incomes, rather than a concern for their safety and well-being.

Those with Stable Subsistence Livelihoods (SSL) are most concerned with their lack of access to agricultural equipment and the fact that at least some of them have land at a distance to their home (Figure 4.5). They report the highest rate of concern for food shortages in the village, but as among those with SPL, for this group food shortage is not the same thing as significant food insecurity. As among those with SPL, those with SSL reporting food shortage generally mention shortages just before the harvest, when their subsistence production begins to run out. However, those in these households generally have the ability to take loans to cover this need, which they pay back with their production at the end of the harvest. This category of stressor also reflects relative shortage, such as the junior women (PW10) who reported food shortage as the inability to make good food like her cowife. In this sense, food shortage is a stressor that forces these households to dedicate a portion of their relatively secure production to the repayment of loans, which limits their ability to invest in the equipment needed to cultivate regular surpluses as among those with SPL.

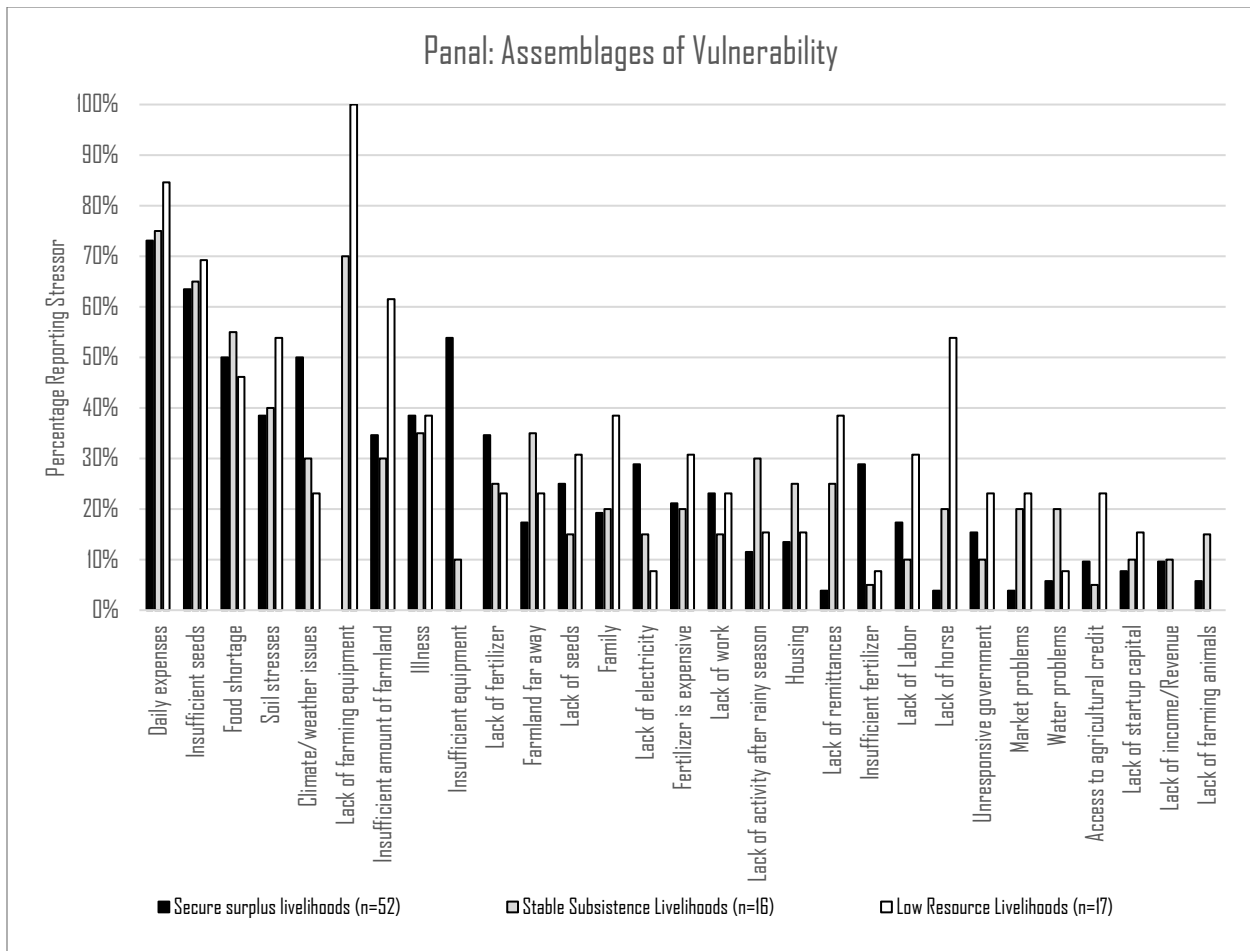


Figure 4.5: A comparison of the assemblages of vulnerability reported by members of each group in Panal

Those with Low Resource Livelihoods (LRL) report an assemblage of vulnerability that places them at significant existential risk. They have the greatest issue with lack of draught animals, access to land, access to adequate agricultural labor, and concerns for health. However, this is not to suggest that members of these households live at the edge of disaster. Their agricultural production is relatively secure, though it often does not reach even to the new farming season. This forces them to take significant loans or sell off assets, compromising both their agricultural production and their ability to accumulate assets after the harvest (as they are paying off loans with any surplus). As a result, their rate of reporting of food shortage is actually lower than among SPL and SSL, principally because they are able to reach subsistence through various means, but are not close to producing significant surpluses that might allow them to accumulate assets and significantly improve their material situation. This is also true of daily expenses, where members of this group report inadequate access to credit. While they can get credit to purchase food and needed agricultural inputs, they characterize this credit as inadequate to fully meet their needs and aspirations. Their concerns for illness reflect this shortage of financial resource, as in these households illnesses often require the taking of loans to pay for medicine, and thus further pressure on the already-stressed harvests they produce each year.

In summary, the assemblages of vulnerability in Panal do not reflect a population that is at the edge of crisis, but instead one that faces significant challenges in changing their material conditions.

Some, such as those with SPL, seek to improve what are already very secure incomes and food supplies. Others, such as those with LRL, seek to improve their incomes and production enough to get out of a state of chronic financial stress. However, nobody in this community reported challenges to agricultural production so severe that they could not cultivate enough food to meet their subsistence needs. Instead, where it exists food shortage is a seasonal issue emerging when households have to commit significant portions of their harvests to loan repayment.

#### 4.2. Comparing vulnerability contexts within Livelihoods Zone 10

Any effort to build an understanding of the livelihoods decision-making across this zone must first assess the extent to which the experiences of the vulnerability context are shared by different residents of that zone. In comparing the vulnerability contexts, and the resultant assemblages of vulnerability in Panal and Ngetou Malick, it is important to contextualize their differences and similarities with regard to their demographic composition and their geographic situation.

First, the sample of residents of Panal suggests a community that, on the whole, is more asset-secure than that of Ngetou Malick. Neither village was sampled through a formalized randomization exercise. Instead, the samples were generated purposively, to capture a range of experiences of the vulnerability context, and a range of roles and responsibilities associated with life in these communities. This includes a conscious effort to interview those with and without assets, as well as to identify gender and other critical social cleavages that shape roles and responsibilities. As the sampling process was the same in both communities, as they were in the same livelihoods zone, and as they have the same ethnic composition, these samples are broadly comparable. As such, it is interesting that a far greater percentage of respondents in Panal reported SPL than in Ngetou Malick (Figure 4.6).

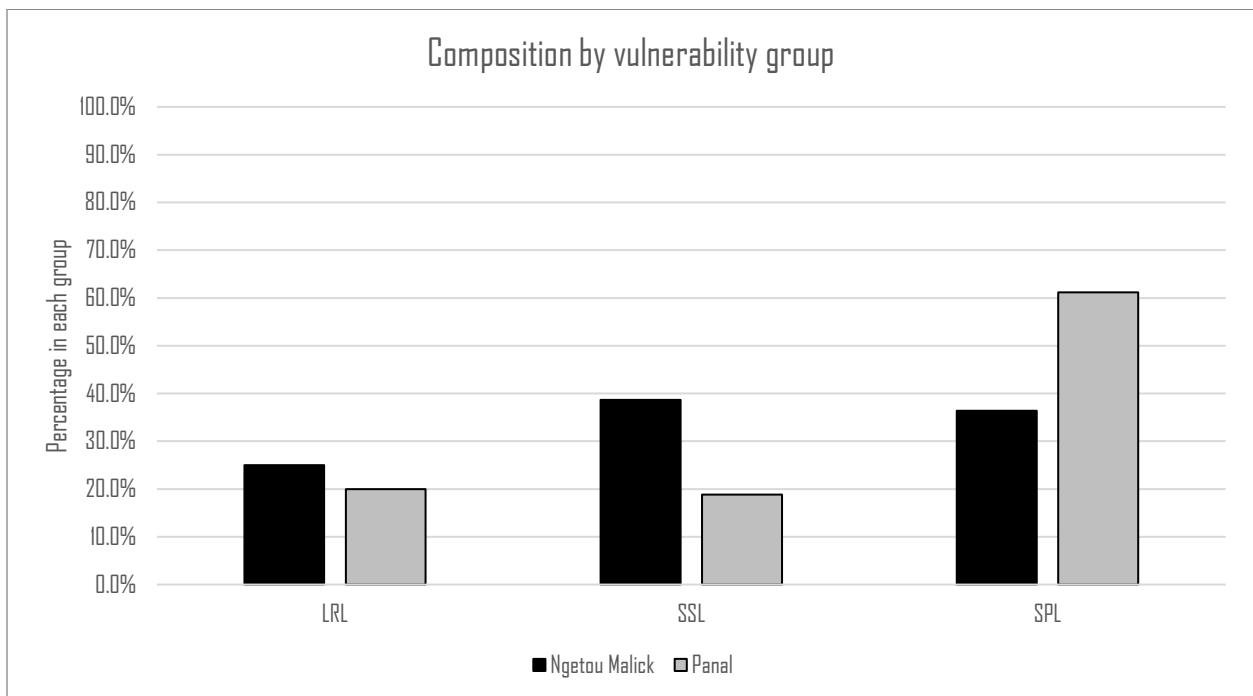


Figure 4.6: The compositions of the samples in the two villages by vulnerability group.

When we compare the reported vulnerability contexts of the two villages, there is a great deal of similarity between them. Further, the differences between these two reported contexts are easily explained by either this difference in the composition of the samples or the different environments and market connections of the two communities (Figure 4.7). As Figure X shows, the rates of reported stresses related to agricultural expansion, typically associated with SPL and SSL livelihoods, are very similar between the two villages. The principle difference between the two contexts is the greater concern for access to seeds in Panal, a function of locally-inadequate government seed distribution. According to residents of Panal, the timing of government-subsidized seed sales is often late, the quality of these seeds is poor, and the amounts available are not sufficient for an acceptable harvest. For example, one senior man argued that if he could get peanut seeds on time he could improve his living conditions (Interview PW25, see also PW01, PW11, PW17). A senior woman argued that government subsidized seeds are of poor quality, and they are not available in sufficient quantities (Interview PG75). A senior man said “anyone who is still expecting to get good seeds from the government doesn't get it, you have to purchase your seeds” (Interview PN21). Farmers in Panal can only access the market organized once a week in Gniiby, Mba , and Mboss. Gniiby is 9km away from Panal and it is the closest. Farmers in Ngetou Malick have access to Ngetou Farba and other neighboring village markets that are organized once a week as well. However, they have the advantage of access to Kaffrine market, which is organized daily and has a diversity of agricultural inputs. Taken together, these factors explain why, among the stressors associated with challenges to achieving subsistence via agricultural production, those in Panal reported higher rates of concern for lack of seeds, but otherwise very similar rates of concern for other stressors. Beyond these goal-specific stressors, the higher rate of reporting for most stressors reflects the fact that Panal is drier than Ngetou Malick and further from urban areas. These facts make agriculture is more challenging, and make transportation of crops to market more difficult. The difference in concern for water access between these two villages reflects different timing of gardening. In Panal, gardening is conducted during the rainy season because, according to residents, the soils are not fertile enough and the local water supply is too salinized to allow for irrigation. While this reduces the value of this activity as a source of dry-season income, it also reduces the need for water supply. In Ngetou Malick, gardening is a dry season activity dependent on irrigation, which makes the population more sensitive to the supply of water and its associated costs. Because the residents of this village draw their water from a neighboring village, the cost of water in time and money is significant.

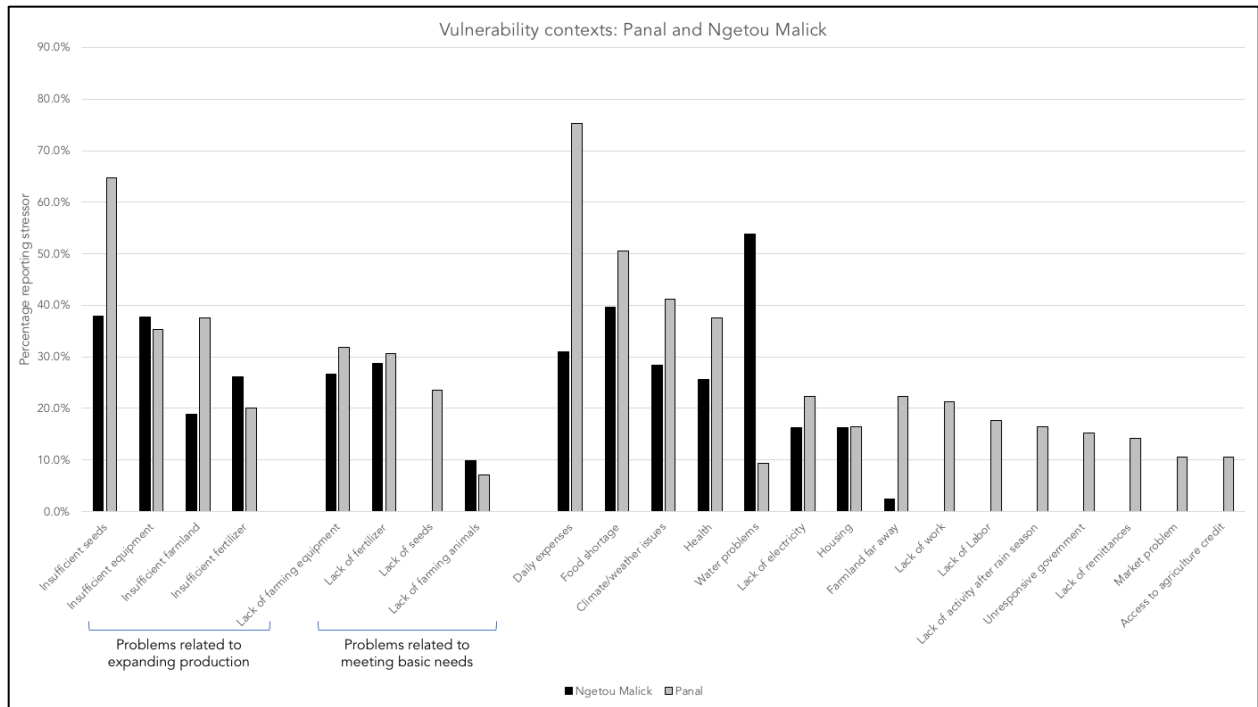


Figure 4.7: Comparison of the vulnerability contexts of the two villages

When we compare the assemblages of vulnerability across the vulnerability groups in the two villages, we also find broad similarities tempered by the specificities of each village context. Those with SPL, whether in Ngetou Malick or Panal, emphasized the same broad set of stressors centered on barriers to the expansion of existing production (Figure 4.8). In Panal, daily expenses such as loans were a larger issue than in Ngetou Malick. Soil degradation was also more reported in Panal, which when combined with broad concerns for access to adequate farmland reported by residents of this village, suggests that Panal is more land constrained than Ngetou Malick. Not all members of this group, however, reported concerns for expanding production. This suggests that while all members of this group are relatively secure in their subsistence and capable of producing surpluses, not all members are motivated to produce such surpluses. Whether seeking to expand production, or simply content with their secure status, members of this group do not express concerns about becoming chronically insecure.



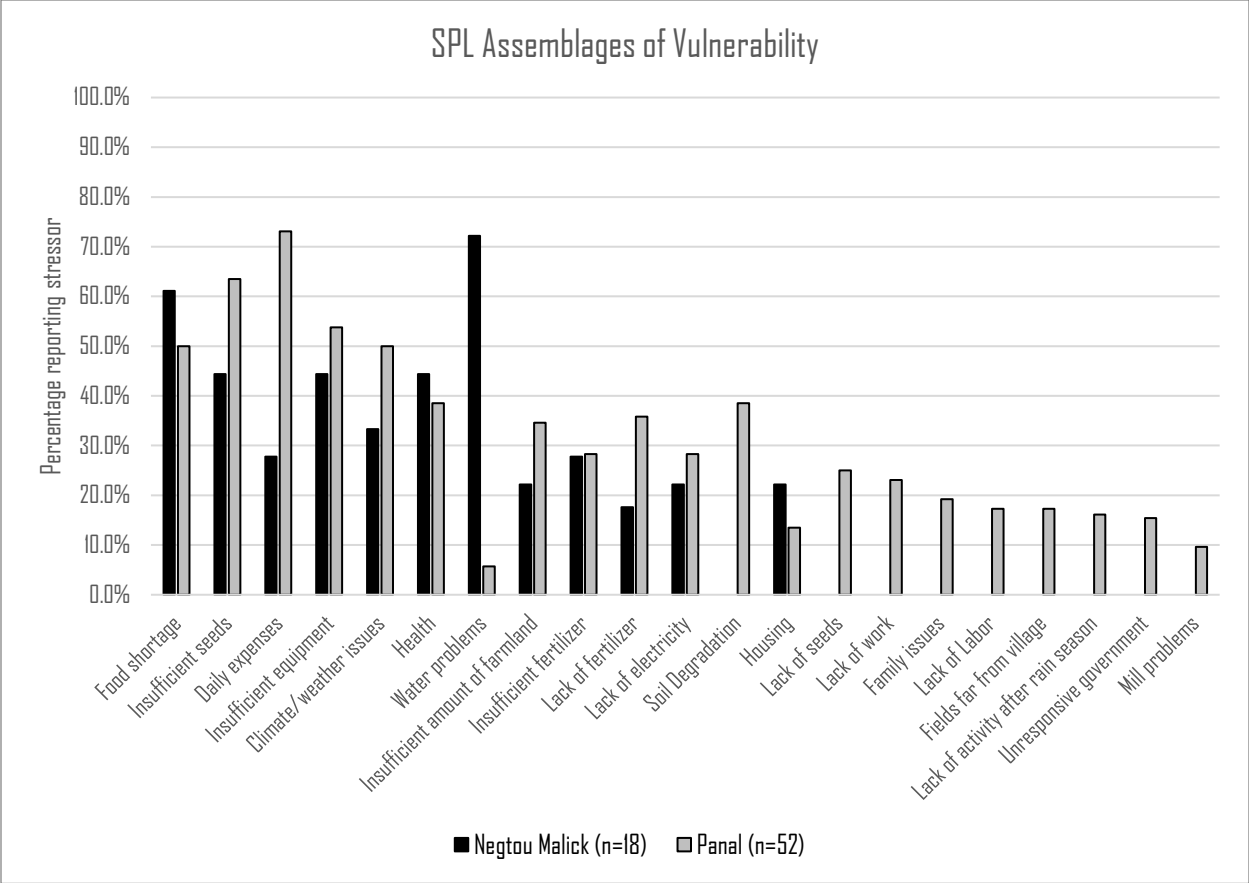


Figure 4.8: Comparing the assemblages of vulnerability for SPL across Ngetou Malick and Panal

Comparing the assemblages of vulnerability associated with those with SSL across the two communities, we see differences that point to the challenges that Panal presents to those who live in it (Figure 4.9). Those in Panal have much higher rates of reporting of lack of equipment, stress related to daily expenses, food shortage, and insufficient seeds, distant fields, and soil degradation. This suggests that those with SSL in Panal have greater barriers to the improvement of their situation to that of SPL than do their counterparts in Ngetou Malick. The fact that those in Panal report a lack of equipment at a much greater rate than those in Ngetou Malick, and that those in Ngetou Malick report insufficient equipment much more frequently than those in Panal, is telling. Insufficiency generally reflects an orientation toward improvement and increase, while lack reflects a concern for the achievement of baseline goals. While members of this group in both villages do not own plows, in Ngetou Malick this problem is one of limitations to production, while in Panal it is a problem of achieving subsistence. While their asset situation is very similar, those with SSL in Panal have greater challenges with regard to land access, soil quality, and access to seeds, thus making delays in plowing their fields more significant with regard to their livelihoods outcomes. In summary, in both communities those with SSL are in a transition between LRL and SPL, but in Ngetou Malick the assemblage of vulnerability reflects a group that sees itself as close to achieving SPL status, while in Panal we see a group that is concerned about falling back to LRL status.

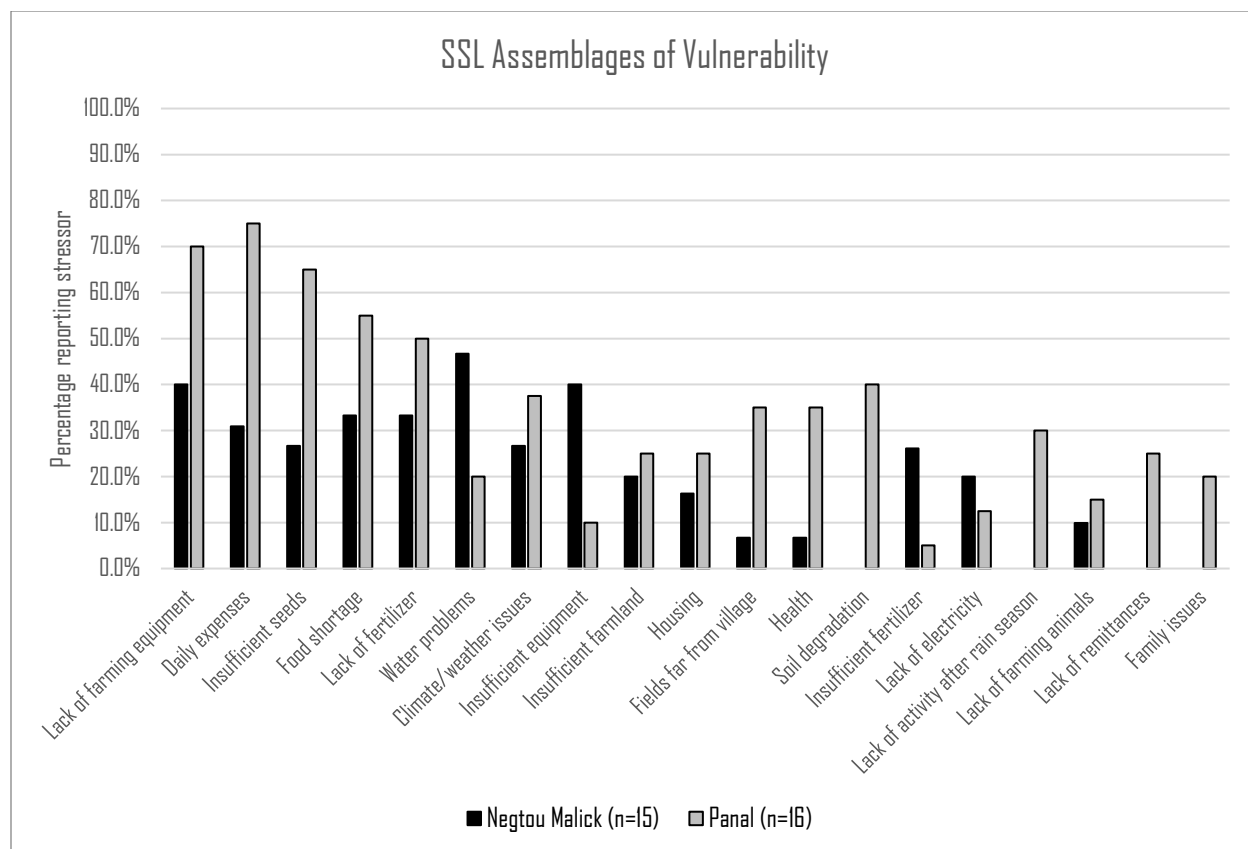


Figure 4.9: Comparing the assemblages of vulnerability for SSL across Ngetou Malick and Panal

Those with LRL in both villages prioritize very similar stressors, though those in Panal report these stressors at a much higher rate (Figure 4.10). These assemblages of vulnerability reflect concerns for the ability to achieve subsistence reliably via agricultural production. At the same time, they also reflect a different set of goals for the members of this group than for those with SPL an SSL. In both villages, those with LRL report very low rates of concern for lack of animal traction despite the fact that no member of this group in either village owns animal traction. This suggests that their access to animal traction is adequate for their goals, which involve subsistence and the repayment of loans. Further evidence for this different outlook is the lack of concern for electrification (a relative luxury that does not directly contribute to subsistence) and low levels of concern for weather and climate stresses. The latter reflects individuals who have no ability to dictate when they will plant, and therefore have few choices except to plant short-cycle crops regardless of the quality and duration of rainfall in the season. At the same time, this comparison provides evidence that those in Panal are significantly more stressed than those in Ngetou Malick. In Panal, the near-universal reporting of lack of equipment as a stressor, along with very high rates of reporting of stress related to daily expenses and access to seeds reflect individuals who are struggling to produce a large enough harvest to both feed their families and yield a surplus that can be invested in greater household production after all loans are repaid. This is reflected in the much higher rate of concern for illness in Panal, an expense that can add additional loans to already overburdened households and individuals and thus compromise even subsistence. In Ngetou Malick, with greater access to markets and seed distribution, and what appears to be more robust production (lack of concern for soil quality, low rates of concern for fertilizer access and food shortage), members of this group do not require as many loans, or loans that are as large as those in Panal.

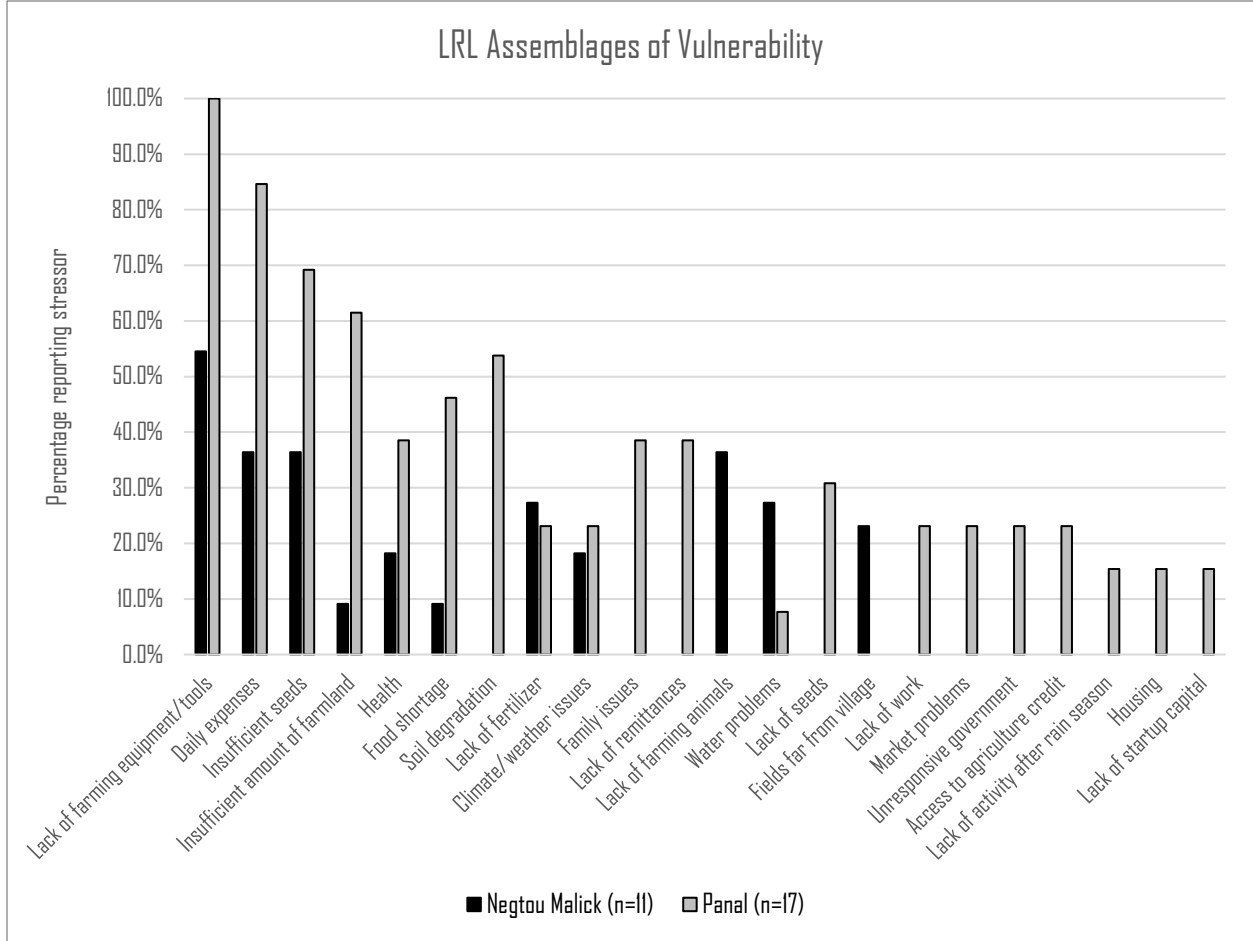


Figure 4.10: Comparing the assemblages of vulnerability for LRL across Ngetou Malick and Panal

### 4.3. Summary of the Vulnerability Context

While Ngetou Malick and Panal are located in different parts of Zone 10, their vulnerability contexts are broadly consonant. As a whole, they emphasize the same stressors, though these are reported in greater numbers by those in Panal due to its distance from markets, seed resources, and its more arid environment. The communities stratify according to reported assemblages of vulnerability in very similar ways, and when we compare the assemblages of vulnerability for each group across the villages we can again see broad similarities that appear to reflect shared goals and concerns among the members of these groups, even though they live in disparate contexts. These findings suggest that this livelihood zone is broadly coherent, and a useful spatial framing of these vulnerabilities. To better understand how these vulnerabilities emerge, and how residents are addressing them, we now turn to an examination of the livelihoods of those living in these communities. This begins with a consideration of identity across these communities, to establish the roles and responsibilities associated with individuals in these communities.

## 5. IDENTITY IN ZONE SN10

Within each of the groups above, different members occupy different social roles with different responsibilities. These social roles and responsibilities in turn impact the decisions they make in

relation to their livelihoods and therefore shape the exposure, sensitivity, and adaptive capacity of their livelihoods in the face of different stressors (Carr 2013; Carr 2014; Carr, Onzere, et al. 2015). Both Ngetou Malick and Panal are occupied predominantly by Wolof farmers, who are also the primary ethnicity in this livelihoods zone (though there are Fulani and Sérère residents as well<sup>4</sup>). Among the Wolof, men control the family's land, the granaries in which family grain is stored, and most agricultural equipment (Perry 2005). The primary responsibility of Wolof men who are the heads of households are to take care of their dependents through the provision of food. As Perry (2005:211) notes, the term for dependents, *surgë*, translates to "one who is filled up," pointing to the significance of food provisioning as a role for male heads of households. Further, such male heads of household must allow married women and the unmarried men in their households the ability to earn money for expenses, and to build up the resources that will allow unmarried men to marry and eventually head their own households. In both Ngetou Malick and Panal, the expectations of a good man largely conform to the literature. Men are the providers for their households, making the decisions that guide agricultural practice and allocating the draught animals and equipment necessary for production. Whether junior or senior, men's primary role is to feed and provide for the family through participating in agriculture. This role is usually met through farming principal rain-fed crops such as peanuts, cowpeas, and millet. If a man is not able to provide food for his household through rain-fed agriculture, he is expected to buy food provisions. In the domestic space, this role is manifest in a responsibility to provide adequate housing and food for their families, and funds to support the agricultural activities of their wives. Beyond providing food and income for his family, a man is expected to take care of domestic expenses, including his wife's expenses (49.4% of respondents in Panal and 90.9% in Ngetou Malick) and respects his wife and community (14.1%/20.5%). Residents of these communities expect that men will lead his family in farming and animal care, and provide tools and land for his wives' agricultural activities. In order to take care of the household, men are expected to buy clothes for his children and/or wife (e.g. PS053, PP081) and pay for their children's' educations (e.g. PG063, PN049).

There are a variety of ways in which men can fail to live up to these expectations. Across these communities, these include a proclivity to abuse his wife/wives (56.5% of interviewees in Panal /20.5% of interviewees in Ngetou Malick reported that this behavior occurred), laziness (43.5%/20.5%), a refusal to give his wife/wives money to support their necessary expenses (grocery procurement, clothing purchase, etc.) (29.4%/20.5%), and not taking care of his family (22.4%/34.1%).

In both communities the household is the principal unit of organization for agricultural activity. As a result, there are few differences in the roles of senior men and junior men, unless the junior man lives in a household controlled by a senior man. Junior Wolof men will stay with their fathers until they are married, which requires that they demonstrate their ability to feed their families (Venema 1978). Thus, junior men with large amounts of debt from agricultural or livelihoods activities, or even from paying bridewealth, cannot separate from their father's households and remain dependent on the father for land and agricultural decisions. According to Venema (1978), the obedience of sons to fathers is of paramount importance among the Wolof, as a son that publicly contradicts his

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<sup>4</sup> Fieldwork in both Ngetou Malick and Panal focused on Wolof agriculturalists because they represent the target population for the weather and climate information provided by the MWG model. To develop a comprehensive understanding of livelihoods decision-making in this zone requires additional fieldwork focused on Pulaar speaking and Sérère residents. The Pulaar-speaking population are highly engaged in pastoral livelihoods, and therefore will have very different framings of how to live in this zone. For a comparison of agriculturalist and agropastoral livelihoods decision-making in a single livelihoods zone, see Carr, et al (2016).

father brings great shame to his family, and may be beaten publicly by the father's friends. It is important to note that the relations of power between senior and junior men, or between head of household and dependent, are reciprocal. In return for access to land and income-earning opportunities, dependents of the male head of household are expected to contribute labor to family farms controlled by the male head (Perry 2005). Therefore, there are expectations on both sides of these relationships that the participants have to live up to. When still living with their fathers, junior men bear less responsibility for feeding and providing for the family. Instead, junior men are expected to follow the direction of the senior man and, through his labor and other contributions, help the senior man meet his responsibility for feeding and providing for the family. This significant difference in roles and responsibilities is manifest in two ways. First, junior men rely at least in part on the resources and assistance supplied by senior men to pursue an agricultural livelihood, specifically relying on the senior man's farming tools and traction animals. Junior men often obtain farmland through senior men as well (PT066, PW006). Second, junior men are expected to follow the advice given by senior men, specifically their fathers and/or older brothers. Men who still live on their father's concession are still seen as junior men, even in the case of wealthier junior men who own farming tools and make their own agricultural decisions (PP083, PP088, PT066, PT067, PW005).

Women in these communities have a different set of roles and responsibilities than men. Their principal role is providers for the domestic needs of their families and supporters of their husbands. As noted in the literature (Venema & van Eijk 2004; Venema 1978), Wolof women are expected to respect (25.9% of respondents in Panal/59.1% in Ngetou Malick) and show deference to men, especially their husbands (53.1%/54.5%). Their principal responsibilities lie with the management of the household, including cooking (30.6%/15.9%) and other domestic activities (28.2%/27.3%) (see also Perry 2005; Venema 1978). At the same time, women are expected to earn money of their own, to take care of themselves and their children and purchase domestic goods and, in polygamous households, to maintain self-respect (Venema & van Eijk, 2004). This is not uniformly true – in wealthy households, the husband may give his wife money for housekeeping (Venema & van Eijk 2004). In Panal and Ngetou Malick, women often must pursue farming and other activities to earn additional income through which to meet these needs because their husbands do not generally provide enough money to purchase all goods necessary for domestic reproduction. Of the 38 women interviewed in Panal, 25 (65.8%) report livelihood activities other than farming and animal husbandry, while 9 of the 21 women interviewed in Ngetou Malick (42.9%) reported such activities. There are significant incentives for living up to the expectations of their roles. For example, the first wife in a Wolof household, if deemed a “good wife”, may become the focal point of domestic decision-making, with authority over the domestic labor of other wives in the household (Venema 1978).

In Zone SN10, the historical expectation of the most junior woman in each household was to complete the largest portion of the domestic duties out of all the wives. Senior women were freed from most domestic duties when their sons got married and brought their wives into the family. The newly married junior wife took over all her mother-in-law's household workload. During fieldwork in 2013, the team heard from one senior woman who was pushing her 18-year-old son to get married so that she could get some rest and devote her time to less labor-intensive activities. In these situations, junior women were not able to dedicate a significant portion of time towards agricultural pursuits or the pursuit of any secondary livelihoods (Interviews NG4, NG25, NG29). Because junior women took up many domestic tasks, these senior women did not have as many household duties to fulfill, meaning that they could spend more time relative to junior women on

agricultural pursuits and other secondary livelihoods to earn more income for themselves and their families. Older women are differentiated from younger women because they often have access to extra labor in the form of their son's wives (Interview NG2). However, in its 2018 fieldwork HURDL noted that a large number of men were moving out of their father's compounds as soon as they were married, bringing their wives with them. This new trend deprives mothers of the labor of their daughters-in-law. Thus, their ability to pursue other livelihoods activities, or to otherwise accumulate assets, is now more limited than in the past. As discussed below, this change is evident in the data, where we see relatively little difference between the livelihoods decisions of junior and senior women. This suggests an ongoing shift in social organization in this zone that will have to be monitored over time to understand its significance for livelihoods. With respect to domestic spending, women are expected to buy groceries (Interviews NG31, NG32), purchase soap to wash clothing (Interview NG32), pay for water (Interview NG31), purchase clothes and shoes for themselves and their children, pay for the education of her children (Interview NG43), and pay for bed sheets (Interview NG40).

Though all women are expected to farm, they are generally limited to usufruct rights to land controlled by their household, which they obtain starting around the age of 13. Women's production is generally seen as less important than that of men, and both Venema (1978) and the HURDL teams in both Ngetou Malick and Panal observed that first sowing and weeding dates were much later on women's plots than men's plots, limiting their production. Women are responsible for procuring their own seed. The first season after they marry, women receive peanut seeds from their husbands as a form of startup capital. From that point forward, women are responsible for maintaining or increasing their stock of seeds. Instead of granting them access to land outright, men choose to rent fields for their wives to use, allowing for season-to-season changes in field size depending on how much seed the women are able to acquire during a particular growing season (Interview NG28). One junior woman reported that husbands will provide their favorite wife or wives (typically the youngest) with extra seeds during the start of the planting season, providing her with a distinct advantage (Interview NG28). However, this is a contentious view as some women believe that being a newer wife does not convey any special advantages (for example, the junior woman in Interview NG29). If a woman does not manage to acquire seeds during a particular year, then her husband will not allocate her a field (Interview NG28). The fields that married women use are often subdivisions of the same plot of land divided up among the wives of each particular man (Interview NG15). The border of each of these fields is marked by the planting of bissap (the local name for hibiscus) as a demarcation of each wife's particular plot within the larger field (Interviews NG15, NG25). Though women's plowing and planting decisions are controlled by their husbands, women commonly maintain control over their own crop selection, regardless of their status as junior or senior (Interviews 2, 28), because they are responsible for acquiring their own seed. While such selection is broadly autonomous, women are expected to grow bissap and cowpea, as these are crops that are integral to making flavorful sauces when cooking (Interviews NG1, NG17). Because the provision of millet and maize is seen as an integral part of a man's responsibility to provide for his family, women are discouraged from growing millet and maize under normal circumstances as this is seen as a threat to a man's role as the provider for the family (PS060, PW014, PW024, PW026, PW028, NG4, NG5). However, if the woman in question is either widowed and must provide for family, or if the woman was not able to procure more expensive peanut seeds for the upcoming rainy season (as millet seeds are very cheap and often seen as a last resort), then they are permitted to cultivate millet without questioning by the community (Interviews NG7, NG10, NG39). In cases where the husband fails to provide land for his wife or in the case of a widowed woman, it is common for brothers or other extended family members to step in and provide land for them

(Interview NG10). Land tenure for all but the richest women is therefore unstable, as the women do not themselves have direct control over the land that they cultivate each year. Among the Wolof, women who work on the fields of men are generally entitled to compensation (Venema 1978).

Women are expected to give leftover peanut straw to their husband (who either use it as animal fodder or sell it) as a sign of respect if he has helped them plow their fields. Additionally, women, especially within this population grouping, typically give their husbands their peanuts, who will then sell them at the market as they are seen as better negotiators (Interview NG28) and because some women feel that lifting and weighing peanut bags at market is labor-intensive and best done by men. Because the men sell the peanuts, women often grant the men a cut of the profits (Interview NG5). This money is, however, ultimately the woman's property, and she can refuse to grant the men any of it if she so chooses (Interview NG25). Women guard against having their profits skimmed by their husbands by listening to the radio, which announces market prices for peanuts and other crops during that particular season. (Interview NG28). There is also a great deal of conversation among women about market prices for peanuts in Ngetou Malick.

Women can fail to live up to their roles and responsibilities if they fail to complete their domestic work or support their husband's agricultural production. Beyond this, they can be seen as failing to live up to expectations if they are a gossip (44.7% in Panal /4.5% in Ngetou Malick) or demonstrate a lack of obedience to and respect for their husbands and others (35.3%/13.6%). Interestingly, one senior woman in Ngetou Malick stated that there is no such thing in her eyes as a bad woman within the village (Interview NG27). According to her, women who are treated properly will turn become good wives, meaning that women behave how they are treated and that any poor behavior is the causal result of a poor husband (Interview NG27).

While the roles and responsibilities described above are widely held across Ngetou Malick and Panal, and therefore likely widely held across all of Livelihood Zone 10, these are made material in the context of the different communities in which individuals live, and the different vulnerability groups to which they belong. To understand the outcomes of this process, we turn to the discourses and practices of livelihoods in these two communities.

## **6. DISCOURSES OF LIVELIHOODS IN ZONE 10**

Livelihoods in Zone SN10 are always marked by a degree of defensiveness, in that they always reflect a concern with the management of risk and vulnerability related to the vulnerability context and an effort to maintain social order (for discussion of the tension in livelihoods between achieving material goals and maintaining social order, see Carr 2008; Carr 2013). For example, while those with SPL are relatively secure in their ability to meet their material needs while living up to their roles and responsibilities, as we illustrate below they continue to farm a diverse set of crops, distribute the use of those crops across subsistence and market sale, own several types of animal, and take up multiple livelihoods activities. This diversification spreads the risks of this zone, ranging from uncertain precipitation to animal disease and theft, across a broad portfolio. Given their relative security, we might see this diversification as the baseline level of defensiveness within the agrarian livelihoods of Zone SN10. Compared to this baseline, we can see additional indications of greater defensiveness among those with SSL and LRL, reflecting their greater precarity and vulnerability.

### 6.1. Comparing the activities of Ngetou Malick and Panal

While located in different parts of Zone 10, residents of Ngetou Malick and Panal emphasize the same activities (Figure 6.1) in their livelihoods. The principle difference between the livelihoods activities reported in the two villages is that the average resident of Panal engages in more activities (3.2) than the average resident of Ngetou Malick (2.5). Across all vulnerability groups, those in Panal engage in more activities than their counterparts in Ngetou Malick. However, this pattern is most pronounced among those LRL. Where in Panal those with LRL engage in an average of 3.0 livelihoods activities, in Ngetou Malick this group averages 1.82 activities.

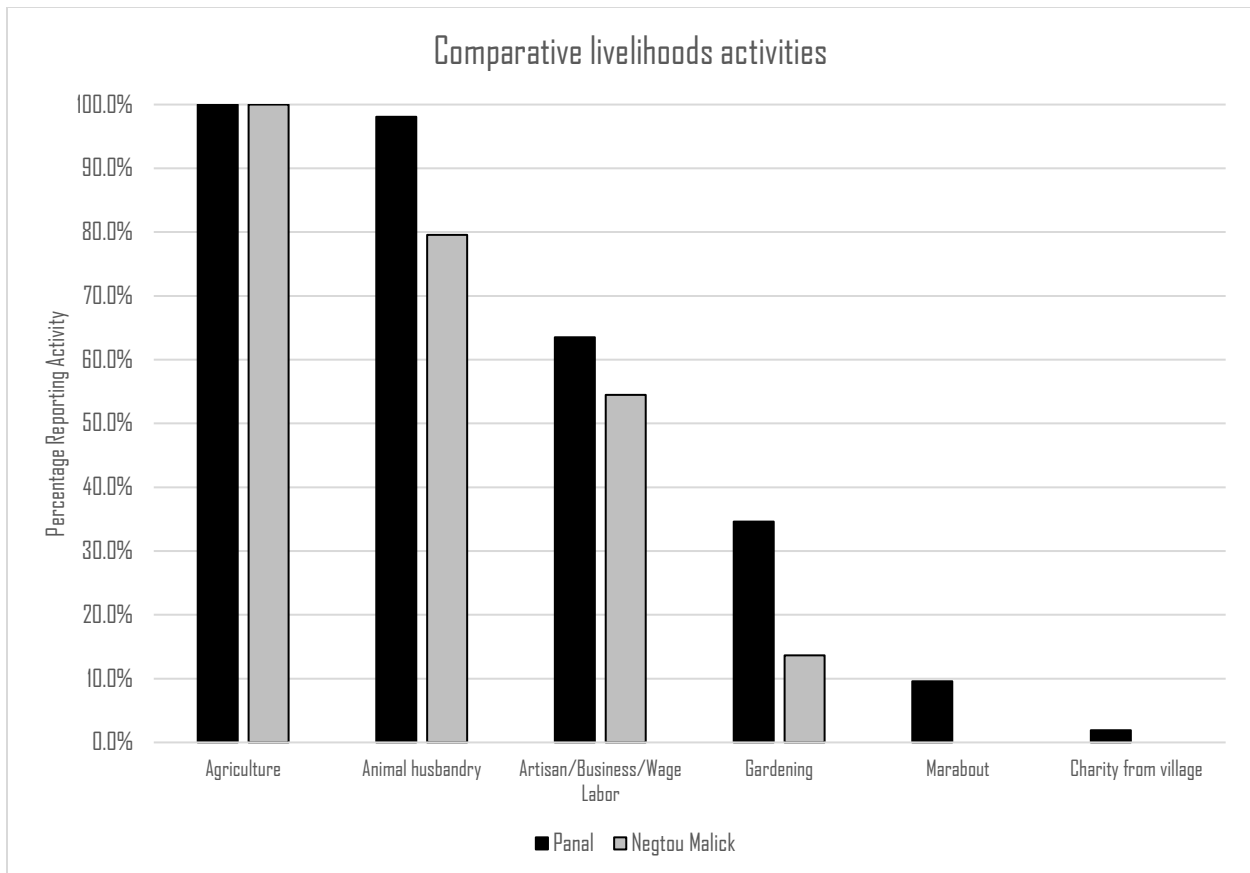


Figure 6.1: Livelihoods activities reported by residents of Panal and Ngetou Malick

Rainfed agriculture is a universal livelihoods activity in these communities, with animal husbandry very common. This is reflective of the broader literature, which represent these activities as the core of Wolof livelihoods in this part of Senegal (Perry 2005; Venema 1978; Venema & van Eijk 2004). A junior man in Ngetou Malick said “agriculture is the principle source of income and food,” (Interview NG24), while a senior woman in Panal said she didn’t know of another business that would help her take care of her family, and that everything she does derives from agriculture (PG75). Many noted that agriculture brings in more income and food than other activities. In short, agriculture is a means to meet many needs through a single activity, such as in the case of the junior woman who explicitly noted that agriculture was the only activity that provided income, permitted her to feed herself, and provided food for animals (PN32).



Non-farming activities are secondary to farming, and can serve a source of revenue that can drive activities like business and gardening. For example, a senior woman in Ngetou Malick identified agricultural production and income as central to her activities, as the money she earns from peanut sales is used for household needs, ceremonies, health care, and her small business (NG08, see also NG13). Similarly, a senior man in Ngetou Malick said “I farm because I have to feed my family and to buy cows, and build a good house. Gardening helps me to get some income during the dry season” (NG06). Even a senior woman in Ngetou Malick who claimed that she earned more money from her business activities than from agriculture noted that she cannot earn enough to buy all the food she can cultivate, so she sees farming as a more useful and valuable activity than business (see also NG41). Gardening is largely a source of additional household food, with only a few residents reporting significant sales of gardened crops. Wage labor in the fields of others is common for asset-poor members of the community to earn some food and/or income during the hungry season as they wait for plows and draught animals become available as their owners finish their field preparations. For example, a junior woman in Ngetou Malick noted that at the beginning of the rainy season she works for other people to get paid in kind (rice, Millet and soap) or money as she is waiting for her field to be plowed (NG20). Such work does not compromise her agricultural activities, but provides resources that augment existing food and income sources in the household. Similarly, skilled artisan or wage labor generally supports individuals and households during the dry season, such as in the case of the senior man who said that his work as a mason complemented his agricultural work, and helped him avoid having to take large loans to make ends meet each year (PN27).

The patterns of crop selection for rainfed agriculture in these two communities also reflect broader expectations in the literature (Figure 6.2). Peanut production dominates the farms of both villages. In this zone, those cultivating millet sow it first, before the rains start, in a practice locally called *farassou*. They then start planting peanuts (often with cowpeas), only turning to other crops after these three have been planted. At the village level, crop selection diverges after peanuts, but reflects the different agroecological situations of these communities. In drier Panal, there is much greater focus on cowpeas and millet, which are hardier in contexts of limited precipitation, while in Ngetou Malick maize production is approximately as common as the production of these hardier crops. Maize, which requires more precipitation to grow, is viable in Panal, but is less viable than other crops. As one man in Panal noted, “The amount of rain necessary to plant peanut is the same required to plant maize as well” (PN23). However, farmers who plant maize generally sow it after they have sown their peanuts and cowpeas. Hibiscus is cultivated principally by women, and while it is often sold for income it also serves to mark the boundaries of their fields.

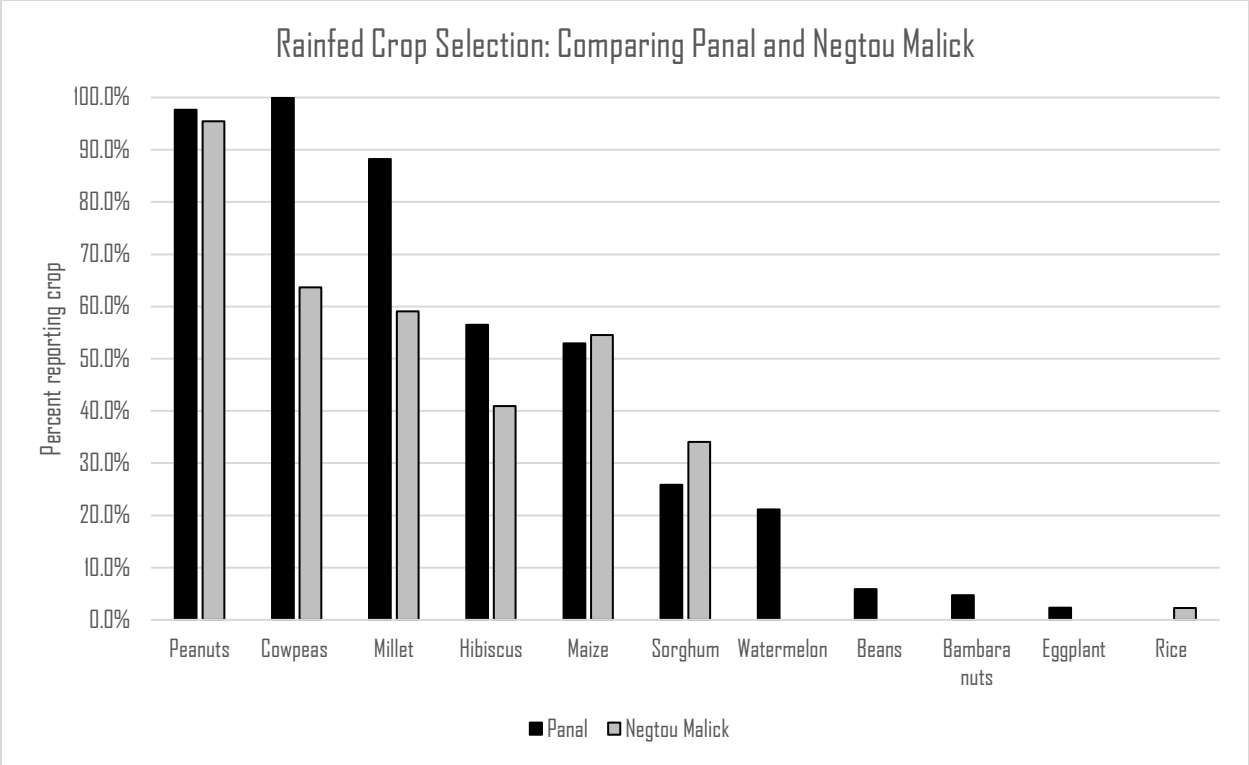


Figure 6.2: Crop selections in Panal and Ngetou Malick

The average farmer in Panal cultivates 4.6 rainfed crops, while the average in Ngetou Malick is 3.5 (Figure 6.3). Across all vulnerability groups, farmers in Panal farm a higher average number of crops. Further, Panal had a substantially higher number of interviewees with Surplus Production Livelihoods (SPL) than Ngetou Malick. As this group reported the largest number of different crops in both villages, this demographic difference further separates the patterns of crop selection seen in these two communities.

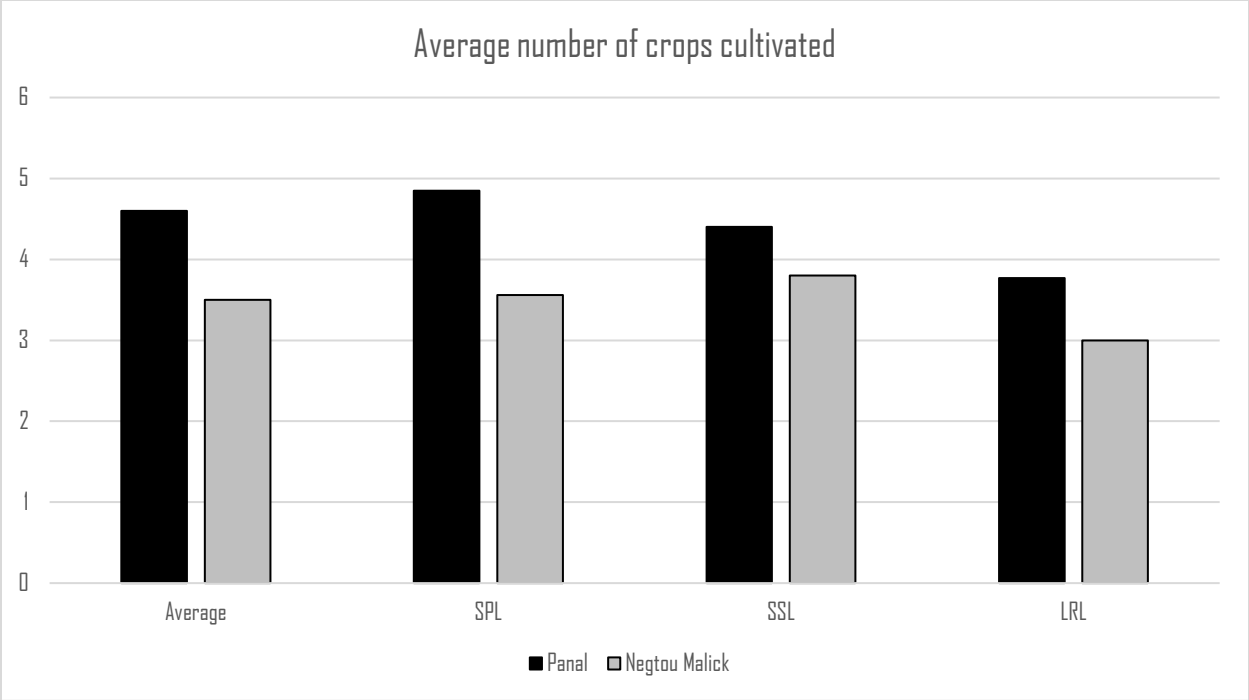


Figure 6.3: Average number of crops cultivated, by village and vulnerability group

The reported uses of crops across the two villages speaks to the overall goals of the agricultural strategy in this zone. The uses in the figure are derived from individual interviews, where farmers were asked to place their use of their crops on an ordinal scale, where 1=eat all, 2=eat more than sell, 3=eat and sell equally, 4=sell more than eat, and 5=sell all. The scores for crops were then averaged across the community to gain an overall understanding of the use of each crop, represented in Figure 6.4. In both communities, peanuts are sold more than eaten, making them a principle source of income for these communities. For nearly all other crops cultivated in common across these two communities, those in Panal see them as more for sale than those in Ngetou Malick. There are very few crops in Panal that are cultivated exclusively for consumption, where in Ngetou Malick most agricultural production is oriented toward subsistence. These reported uses suggest that those in Panal are somewhat more market-engaged than their counterparts in Ngetou Malick.

### Crop Uses by Village of Residence

	Peanuts	Watermelon	Sorghum	Eggplant	Tomatoes	Bambara nuts	Cowpeas	Okra	Chili pepper	Hibiscus	Millet	Maize	Pumpkin	Squash	Rice
Panal	Sell more than eat	Eat and sell equally	Eat and sell equally	Eat and sell equally	Eat more than sell	Eat more than sell	Eat more than sell	Eat more than sell	Eat more than sell	Eat more than sell	Eat more than sell	Eat all	Eat all	Eat all	
Ngetou Malick	Sell more than eat		Eat more than sell				Eat all			Eat all	Eat all	Eat all			Eat all

Figure 6.4: Reported uses of crops from Panal and Ngetou Malick. Darker colors represent greater market sale of a crop, while blank cells represent crops either not cultivated in that village, or for which there was no reported use.

In Ngetou Malick, peanuts (and the peanut straw left behind after harvest) are seen as the means to raise income for investment in other livelihoods activities, personal needs, household expenses, and to provide fodder for animals. In short, peanuts are the core source of income in this community. After peanuts, gendered associations with crops become clear. Sorghum is a useful animal fodder largely consumed within the household, but sold if surpluses are available. It is often viewed as a men's crop, and therefore women's cultivation could become a source of conflict. However, sanctions against women who cultivate sorghum appear to be limited to ridicule by men, and do not appear to escalate (Interviews PN34, PN40). Millet is viewed as an inexpensive crop that grows even when there is little rain, and is principally for consumption (though a few residents report selling small surpluses to purchase fertilizer or other needs). For example, one senior man reported using three quarters of his millet harvest for food, and saving the remainder for seed for the following year. He only sold millet when he thought he had enough food, a decision consistent with his responsibility to feed his family for the entire year (NG01). Millet is seen as a man's crop, but women can cultivate it if they are unable to afford peanut seeds. Maize, another men's crop, is viewed in a similar manner. In both cases, women's fields are very small, and therefore not substantial enough to produce appreciable yields that might generate income and threaten men's status. Farmers report planting short-cycle maize to address the short growing season, but a few reported growing surpluses large enough to allow for some sale at market. Cowpeas are often intercropped with peanuts, and provide another source of food. Only one farmer in this community reported selling any cowpeas. Hibiscus is principally used to mark the boundaries of fields, though it is also consumed. It is also widely viewed to be a woman's crop. There are two types of hibiscus reported in this community – nearly all residents were cultivating white hibiscus, which they used for consumption. One senior woman reported cultivating both white hibiscus, which she consumed, and red hibiscus, which she sold. Across Ngetou Malick, agriculture is principally focused on subsistence, with peanuts as the only reliable source of agricultural income. Crop selections are influenced not only by the reliability of the crop under local conditions, but also its ability to provide fodder for animals (peanuts, sorghum, some forms of cowpeas).

In Panal, peanuts are principally a source of income used to address virtually every financial need. These range from investments in agriculture or other activities to the payment of school fees to the purchase of rice. For example, one senior man said that after he sold his peanuts, he paid medical bills, repaired his house, and purchased rice (PN21). A few residents of Panal referenced the use of peanut straw for fodder, reflecting the lower rate of large animal ownership in this community relative to Ngetou Malick. As Figure 5.4 demonstrates, residents of Panal sell a fraction of many more crops than their counterparts in Ngetou Malick. Of these, sorghum is the most commonly cultivated. Residents cultivate it for both food and fodder, a somewhat different emphasis than in Ngetou Malick, where sorghum was not reported as a food and therefore was principally fodder for horses and sheep. Frequently farmers did not mention cultivating sorghum during initial interviews, suggesting they either do not see it as very important, or otherwise see it as having low value. Women often noted that sorghum was seen as a men's crop, and if they cultivated it they would likely create conflicts. For example, one junior woman said if she cultivated sorghum, her husband would ask if she believed she was a man (PN32). Watermelon is a relatively uncommon crop, in part because it requires constant attention and pesticides (PN21). It is cultivated, however, because it can bring in more money than peanuts (PN21). This value of this crop is supported by a junior man who said he used the sale of his watermelon to buy sheep, suggesting this crop has significant value (PN35, see also PS53). As in Ngetou Malick, various staples, such as maize and millet, are seen as men's crops (PS60, PW14, PW24, PW26, PW28), though residents reported that there would not be any sanctions applied to women who wanted to cultivate these crops. Millet is a subsistence staple

that men sell only in situations where there is a significant need of income (PT69, PT82, PW07, PW30). Women cultivating millet tend to sell slightly more of their harvest and use it to purchase household items, pay for costs like school fees, or even buy other kinds of food. Throughout Panal, agriculture is an activity aimed at subsistence, but a subsistence earned not only through the cultivation of food, but also through the investment of income in other activities and assets to diversify individual and household situations.

Unlike rainfed agriculture, gardening is not a universal activity in these communities. It is also practiced differently, serving as a rainy season activity in Panal and a dry season activity in Ngetou Malick. It is substantially more common in Panal, but even then only 36.5% of respondents reported this activity. Figure 6.5 compares garden crop selection across the two communities among those who reported participating in this activity. Participation rates in Ngetou Malick are so low that there is no way to capture reliable differences among vulnerability groups in this community, or across these communities. As noted above, the low rate of gardening in Ngetou Malick is related to challenges accessing water for the irrigation of garden plots, a stress reported frequently in this village. As noted above, in both communities garden crops are largely consumed by those who cultivate them, with only a few residents reporting the sale of these crops.

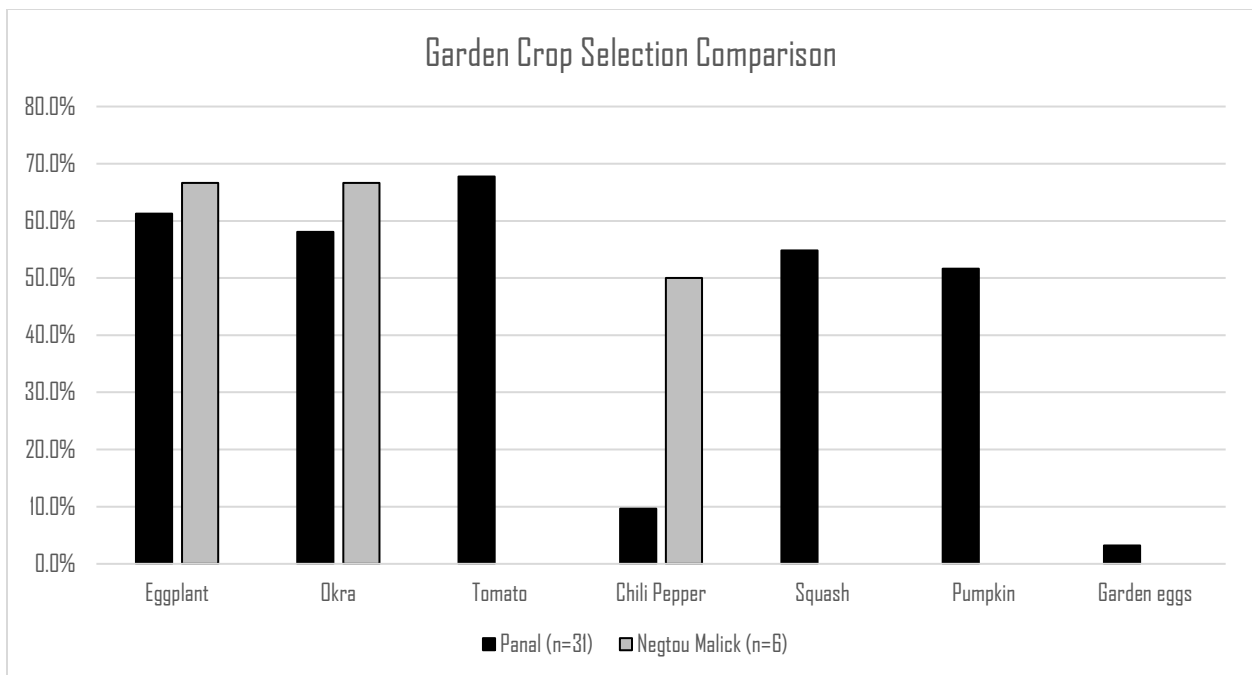


Figure 6.5: Garden crop selections in Panal and Ngetou Malick.

The diversity of animal ownership is very similar across the two villages (Figure 6.6), with residents of Panal (2.0 animal types per resident) reporting slightly more diverse animal holdings than residents of Ngetou Malick (1.6 animal types per resident). The difference at the village level is principally a product of the large difference in rates of animal ownership among those with LRL. In Panal, those with LRL own an average of 1.6 animal types, while in Ngetou Malick members of this group own an average of only 0.4 animal types.

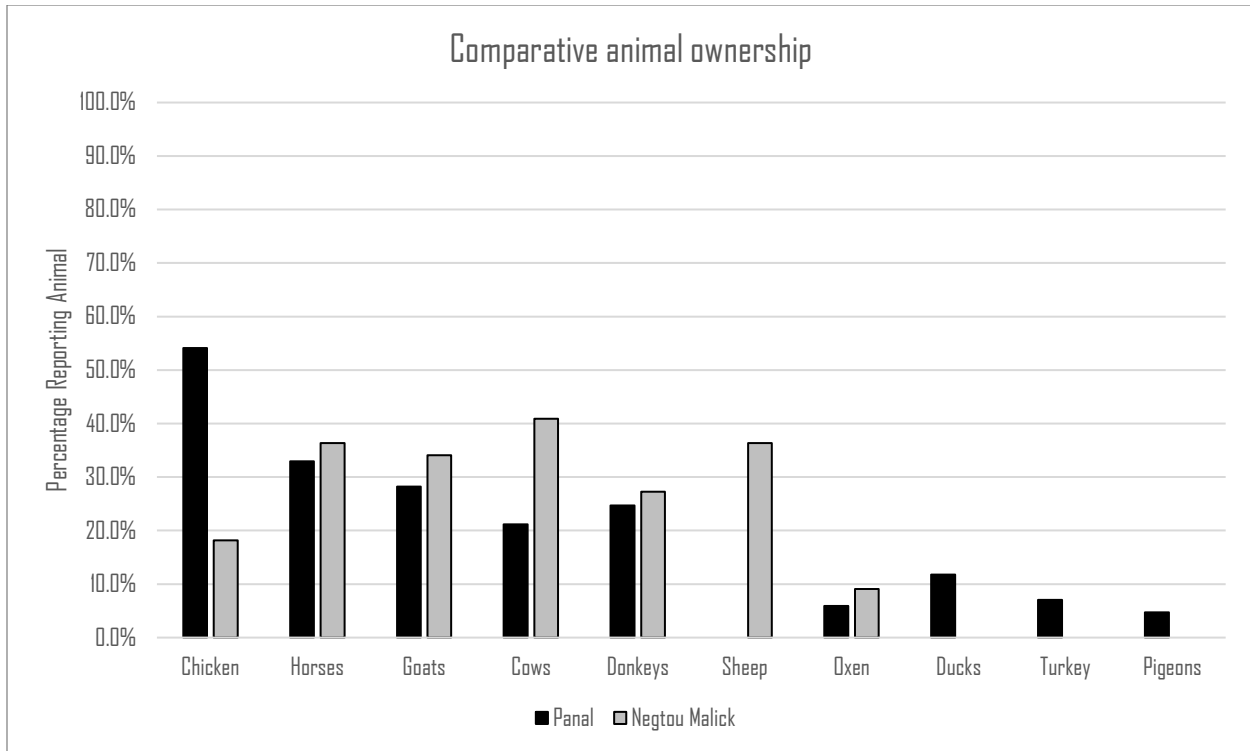


Figure 6.6: Animal ownership in Panal and Ngetou Malick.

While their animal holdings may be less diverse, those in Ngetou Malick are slightly more likely to own draught animals. This aspect of animal ownership has a significant impact on agricultural practice in the two communities. HURDL field teams observed that most farmers in Panal practiced minimal tillage, while in Ngetou Malick nearly all farmers fully tilled the soil. Among draught animals, cows are particularly valuable because they can provide traction and also milk. The milk can be consumed, but also sold “when there is need of major investment in agriculture like buying new farming equipment or seeds to recover from a bad season” (senior man in Interview NG01). More infrequently, residents mention selling cows to address household needs, though such circumstances appear to be severe, such as in a failed or inadequate harvest (NG06, NG13, NG19, NG34, PP85, PS43, PS51, PT65) as opposed to a short-term shock. As one junior man said, “cows are like our bank” (PP85). Oxen are used for agriculture, but can be sold when they are old or when they do not perform well in the fields (NG01, NG13). Horses are used for farming during the rainy season and male horses are used for transportation during the dry season (NG11, NG12, NG17, NG31, PW03). There is a law in Senegal preventing the use of female horses for pulling carts. Thus, horses are a means to generate income throughout the year, which is particularly important as many farmers take loans to enable their agricultural production. For example, one junior man explained his participation in transportation during the dry season, saying “During the farming season I take so many debts and during the dry season I have to find another source of income to pay off my debts accumulated during the rainy season to buy farming inputs and to rent farming equipment” (NG31). Some residents reported selling foals to raise income (PN09, PN21, PT65). Donkeys are principally used for transportation of agricultural inputs to and from the farm, as well as the transportation of agricultural produce to market for those who do not own horses. These animals are important for agricultural production. Few farmers report using them to plow and prepare fields (NG02, PN27, PN33, PS39, PW17), and most who do live in Panal, where animal traction is scarcer. Others report using these animals to transport manure and other tools and inputs to their fields (NG03, NG13,

NG17, NG24, NG33, NG34, PG63, PN15, PS47, PT65). There were no mentions of using horses as sources of savings to be sold during periods of stress or crisis, and only one man (PT71) mentioned using donkeys in this way. Indeed, the field team heard of a case of a man who tried to sell his horse, only to run into significant resistance from his second wife and oldest son, who would not allow him to leave the compound with it.

Nearly half of those in Ngetou Malick report owning sheep or goats, while less than a 30% of those in Panal owned these animals. This does not reflect a difference in the perceived value of these animals, but instead a difference in 1) the ability to purchase them, as the most common reason given for not owning these animals by those in Panal was a lack of money to buy them and 2) a high reported incidence of animal theft in Panal. In both villages, goats are principally used as means of storing savings in the dry season, for *Tabaski* sacrifices, and are never eaten by their owners as they are too valuable. A junior woman said “goats are sold when there is an urgent need of money for ceremonies and sickness” (NG09). This is also true for sheep in Ngetou Malick. For example, a junior man in Ngetou Malick said he sells his sheep “when in urgent need of money” (NG03), while a junior woman said she would “sell if she has financial difficulties” (NG07). In Panal, nearly 78% of resident own poultry, while only 18% of those in Ngetou Malick report owning these animals. Poultry are generally eaten. Poultry are also sources of savings, but they can also be eaten for special occasions (NG30). These animals have little value, and therefore are most useful for sale when a resident needs “quick money” (PN21). One junior woman claimed that she raised poultry only to eat them (NG43, see also PN36). Therefore, while the average number of animals the residents of Ngetou Malick own is smaller than in Panal, the value of those animals for agricultural production and market sale is higher than that owned by the average resident of Panal.

Broadly speaking, the livelihoods activities of Ngetou Malick and Panal are similar, in terms of activities, crop selection, and animal selection. The differences between these villages are largely explained by 1) the drier, more remote location of Panal, which pushes farmers toward crops that are better suited to the environment and 2) the larger percentage of those with SPL in the Panal sample. It is notable that it appears that those with LRL in Ngetou Malick are materially worse off than their counterparts in Panal, farming fewer crops and owning fewer animals. While rates of animal ownership are very similar for the other two vulnerability groups, those in Ngetou Malick own more valuable animals and more types of draught animal, making their agricultural production and broader livelihoods more resilient in the face of shocks and stressors. Those in Panal appear to compensate for this by taking up a wider number of dry season activities to earn money that can be used to pay off loans or meet the financial needs created by acute shocks and stressors. They also seem more prepared to sell some of their crops for this purpose than those in Ngetou Malick.

As the data presented above suggests, while the residents of these two village engage in similar activities and own similar assets, their levels of engagement with these activities, their approaches to agricultural production, and the specific types of animal assets they own differ. These patterns will also vary within these villages, producing different patterns of activity and outcome that must be assessed to understand what these livelihoods manage in Zone 10.

## **6.2. Livelihoods by Vulnerability Group**

While discourses of livelihoods and understandings of the roles and responsibilities attached to particular identities are broadly shared in Panal, the ways in which people enact these discourses, roles, and responsibilities varies depending on their access to assets and their perceived

vulnerabilities. By examining the intersection of discourses of livelihoods and identity in each vulnerability group, we can better understand how these broad understandings take particular shape for different residents of this livelihoods zone.

### 6.2.1. Surplus Production Livelihoods

Those with surplus production livelihoods are not only secure in their subsistence, but also confident in the knowledge they will produce a surplus of food and income that can be used for investment in their activities, or for addressing challenges that arise in their everyday lives. The average member of this group in Panal reported 3.23 activities, while those in Ngetou Malick reported 2.9. Residents of both villages reporting near-universal participation in both rainfed agriculture and animal husbandry (Figure 6.7). The difference in the average number of activities is a product of consistently higher rates of engagement with artisan/business activities, gardening, and wage labor in Panal, though the overall pattern of engagement with regard to the most reported activities and their relative importance is very similar across SPL livelihoods in the two villages.

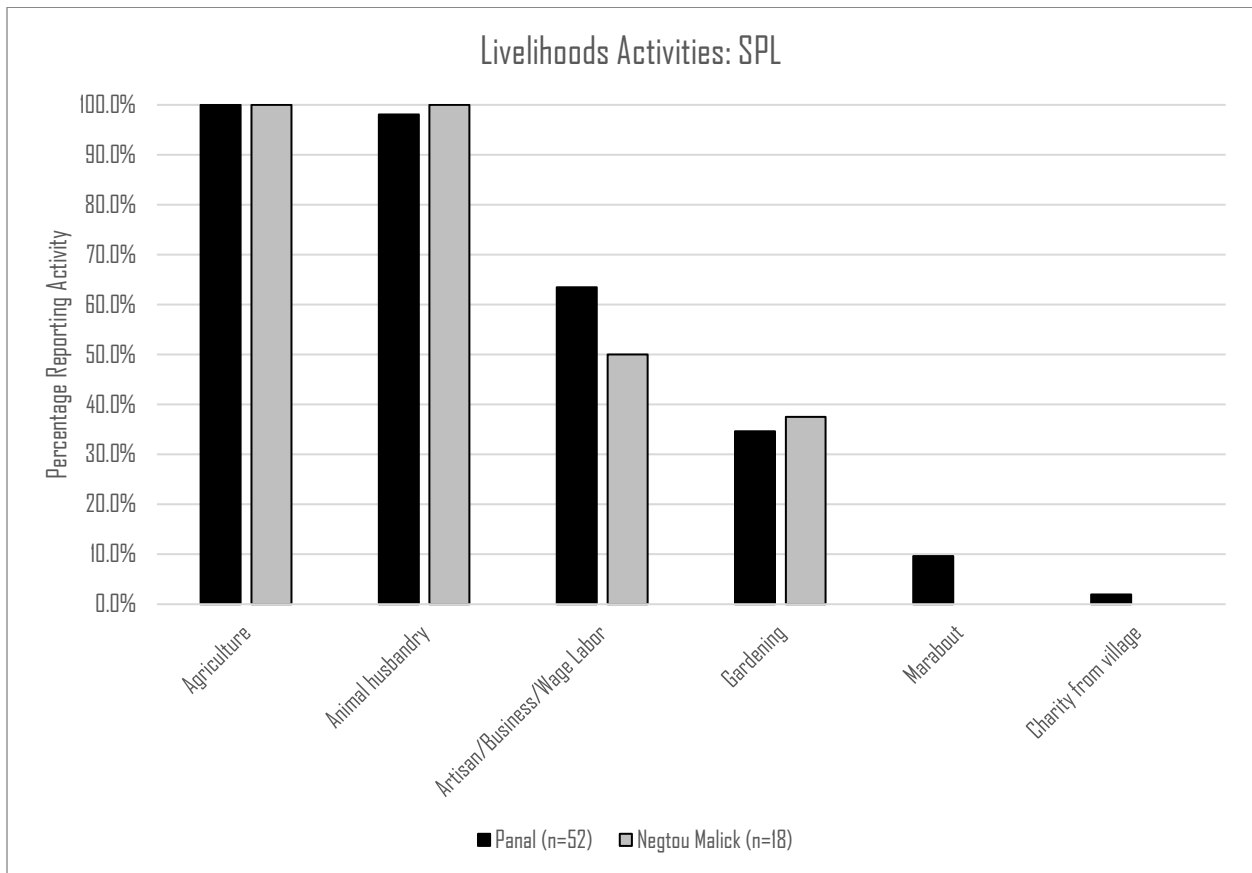


Figure 6.7: SPL livelihoods activities reported by village.

To identify intra-community and even intra-household differences in patterns of engagement with livelihoods activities, we stratified those with SPL livelihoods by gender, seniority, and their community of residence (Figure 6.8). As agriculture and animal husbandry were near-universal activities, identity had no effect on engagement. Members of this group in Panal saw agriculture as a means of supplying the household with food and income. A majority of women, regardless of seniority, emphasized agriculture as a means of producing food over earning income, while most men who offered a rationale for this activity saw it as meeting both food and income needs. For



example, one senior man referred to agriculture as an excellent activity because it allows him to feed his family, buy animals, and obtain fodder. Through these activities he “takes care of his family” (Interview PN31). In Ngetou Malick, men with SPL reported the sale of crops for income somewhat more frequently than their counterparts in Panal, but at the same time noted that they used the income to care for their families. The connection between agriculture and livestock was made clear by a senior man who said “if you want to do animal husbandry, you have to start with farming” (NG01). Beyond their obvious utility as sources of traction, members of this group own animals to fatten them or to have them reproduce, so they can be sold for small profits. They also exist as sources of savings that can be mobilized in crisis situations, and because this group has a much higher rate of ownership of large animals, they are able to mobilize larger amounts of money to address acute challenges.

Senior women with SPL were somewhat more engaged with business and artisan activities than any other group (there were only two junior men with SPL in Ngetou Malick, and in the other groups their participation in these activities is reported at a much lower rate that appears to be independent of assets. This makes their 100% reporting rate for these activities difficult to interpret rigorously, and somewhat suspect. Similarly, there was only one senior women with SPL in Ngetou Malick, and her responses could be idiosyncratic). Business activities in this group provide funds for domestic needs, but also allow individuals to make personal purchases. One junior woman said that business allowed women to purchase beautiful sheets and decorate their rooms. This woman reported buying a bed and chest of drawers through her business income (Interview PW26). Women in this group also report using business income to participate in a tontine organized in the village (Interview PW16). Gardening is also gendered, with women participating at higher rates than men overall, and women in Panal more than any group. It is likely the difference in participation among women by residence is a function of the water supply challenges that limit irrigation in Ngetou Malick. Women generally view garden crops as a source of subsistence, while men who cultivate gardens tend to market the majority of their harvest. Wage and day labor appears to be almost exclusively provenance of men. An interesting pattern in this group is that seniority does not appear to have a large effect on participation in a given activity compared to gender and village of residence.

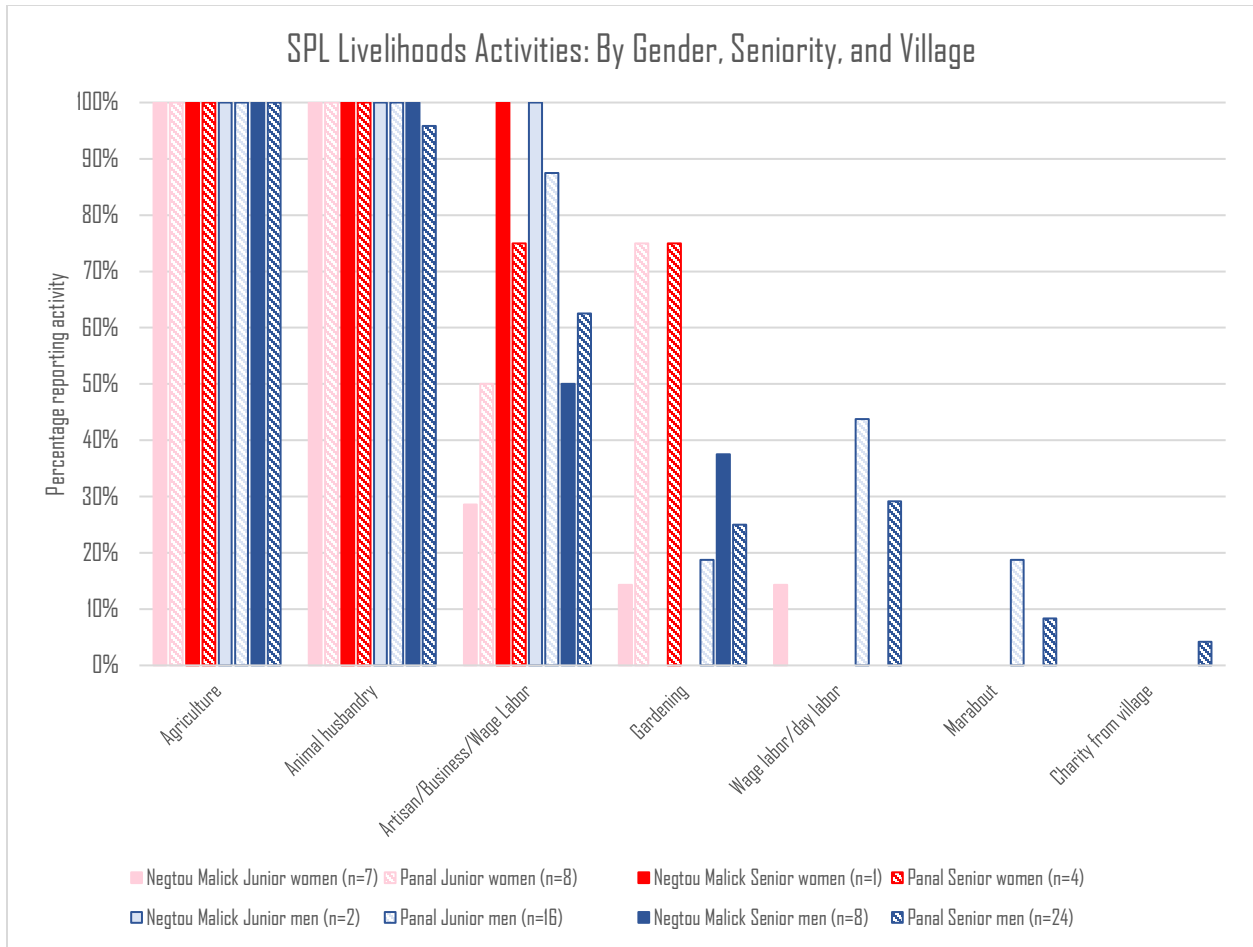


Figure 6.8: SPL livelihoods activities reported by village, gender, and seniority.

Rainfed crop selection among those with SPL centered on peanut production (Figure 6.9). Beyond peanuts, SPL farmers emphasized the same crops in the same order of importance across the two villages. Those in Panal cultivated an average of 4.9 crops, to 3.6 in Ngetou Malick. Those in Panal reported higher rates of cultivation of cowpeas, millet, and maize, and exclusively reported some vegetables in their fields.

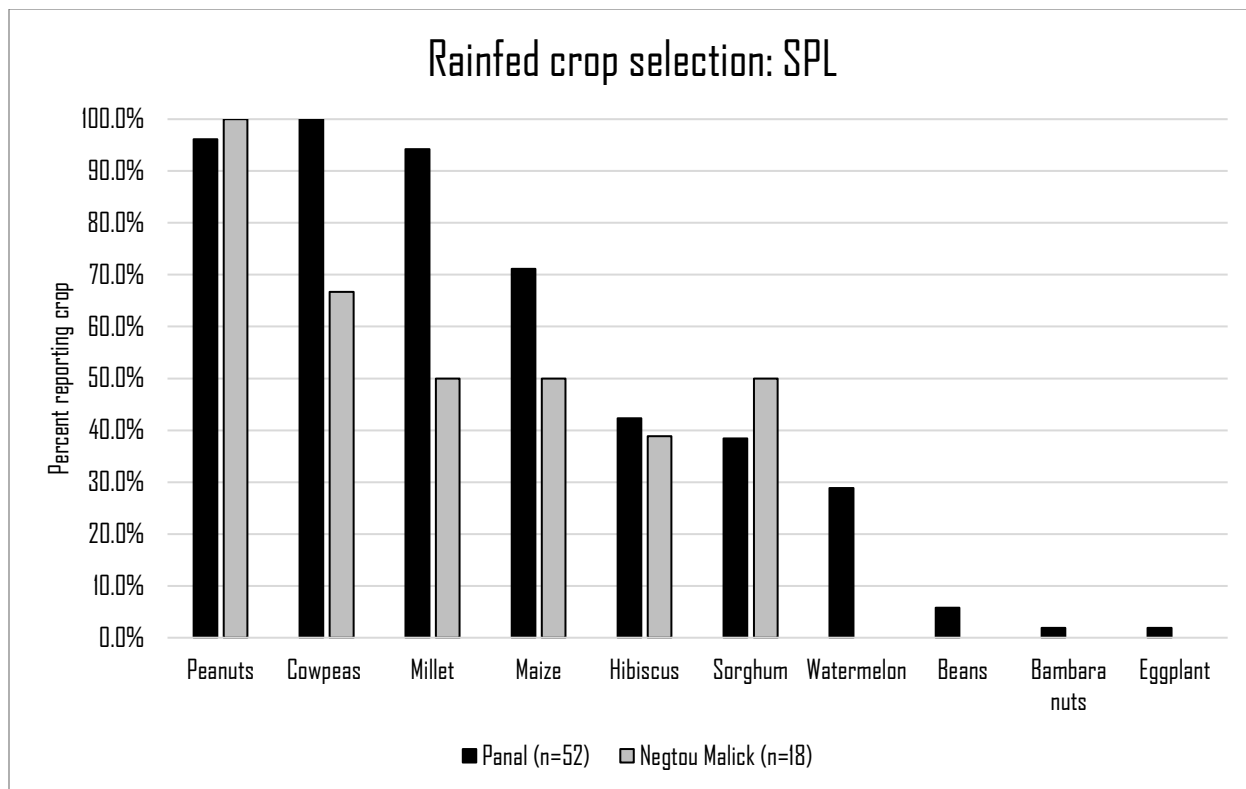


Figure 6.9: SPL crop selection reported by village

When disaggregated by gender, seniority, and village of residence, some patterns emerge (Figure 6.10). First, sorghum, millet, and maize are dominantly cultivated by men, consistent with expectations of their roles and responsibilities (and the fact that women’s millet cultivation is looked down upon in these communities). It appears that senior men cultivate sorghum more frequently than junior men, and senior men in Ngetou Malick show an unusually low interest in cowpeas given universal cultivation of this crop by all other groups in both communities. Hibiscus, on the other hand, is nearly exclusively a women’s crop. Interesting in this group is that there are a significant number of senior women cultivating millet, a crop that is clearly identified as a man’s crop that women can only cultivate when they cannot afford peanut seeds. These senior women all report eating the majority of their harvest, with one women reporting selling half of the harvest and using the income to pay the household’s water bill. While this fits into women’s roles as maintaining the domestic needs of the household, it impinges on men’s role as providers. This was acknowledged by one junior woman who said that she did not cultivate millet because “it is reserved for men and destined to family consumption” (PW24). Further, the women in this group conform to the expectation that they will not cultivate maize and sorghum. While maize is precipitation-sensitive, and therefore women might avoid it because they plant later in the season than men, sorghum, like millet, is relatively drought tolerant. Therefore, it appears that senior women in these relatively secure households are granted more leeway with regard to their crop selections than are women in less secure households.

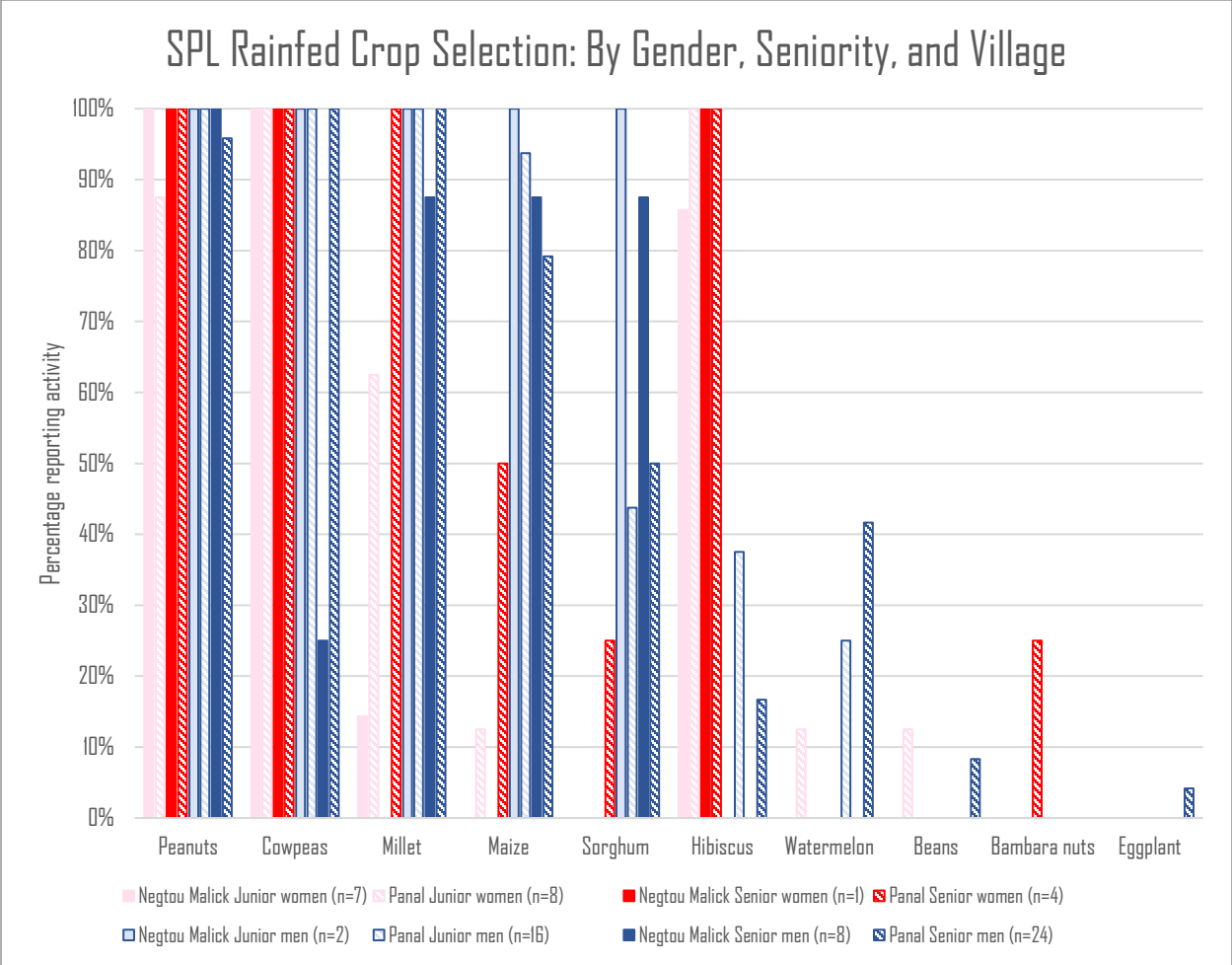


Figure 6.10: SPL crop selection by village, gender, and seniority

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## SPL Crop Uses by Gender, Seniority, and Village of Residence

	Peanut	Eggplant	Watermelon	Sorghum	Tomatoes	Okra	Cowpeas	Maize	Hibiscus	Millet	Pumpkin	Bambara nut	Squash
Panal Junior women	Eat and sell equally	Eat all			Eat all	Eat more than sell	Eat and sell equally	Eat all	Eat more than sell	Eat more than sell	Eat all		Eat all
Ngetou Malick Junior women	Eat and sell equally						Eat all		Eat all				
Panal Senior women	Sell more than eat			Sell more than eat	Eat more than sell	Eat more than sell	Eat and sell equally	Eat all	Eat and sell equally	Eat all	Eat more than sell		Eat all
Ngetou Malick Senior women	Sell more than eat						Eat all		Eat all				
Panal Junior man	Sell more than eat	Sell more than eat	Eat and sell equally	Eat and sell equally			Eat more than sell	Eat more than sell	Eat more than sell	Eat all		Eat all	Eat all
Ngetou Malick Junior man	Sell more than eat			Eat more than sell			Eat all	Eat all		Eat all			
Panal Senior man	Sell more than eat	Sell all	Eat more than sell	Eat and sell equally	Eat and sell equally	Eat and sell equally	Eat more than sell	Eat all	Eat all	Eat all	Eat all		Eat all
Ngetou Malick Senior man	Sell more than eat						Eat more than sell	Eat more than sell		Eat more than sell			

Figure 6.11: Reported SPL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.

illustrates, men are somewhat more market-oriented in their production, viewing more crops as for sale than women. Those in Panal are also somewhat more market-oriented in their production, when compared to their counterparts in Ngetou Malick. As agriculture is the basis for livelihoods in this group, and the acquisition of assets such as livestock starts with agricultural production, this slight difference in orientation across the two communities is not surprising. As noted above, those with SPL in Panal often have only one type of draught animal, and often only one of those animals. This leaves them vulnerable to shocks, and therefore the acquisition of more, and more types, of draught animal is critical to their long-term security. Crop sales are the largest sources of income for these communities, and are the means by which people are able to buy these animals. Further, those in Panal have to contend with less precipitation than those in Ngetou Malick, and therefore distributing income generation across a range of crops is an effective hedge against precipitation shocks and stresses. In Ngetou Malick, production is more secure, and therefore surplus production is more focused on peanuts as opposed to a wider range of crops.

## SPL Crop Uses by Gender, Seniority, and Village of Residence

	Peanut	Eggplant	Watermelon	Sorghum	Tomatoes	Okra	Cowpeas	Maize	Hibiscus	Millet	Pumpkin	Bambara nut	Squash
Panal Junior women	Eat and sell equally	Eat all			Eat all	Eat more than sell	Eat and sell equally	Eat all	Eat more than sell	Eat more than sell	Eat all		Eat all
Ngetou Malick Junior women	Eat and sell equally						Eat all		Eat all				
Panal Senior women	Sell more than eat			Sell more than eat	Eat more than sell	Eat more than sell	Eat and sell equally	Eat all	Eat and sell equally	Eat all	Eat more than sell		Eat all
Ngetou Malick Senior women	Sell more than eat						Eat all		Eat all				
Panal Junior man	Sell more than eat	Sell more than eat	Eat and sell equally	Eat and sell equally			Eat more than sell	Eat more than sell	Eat more than sell	Eat all		Eat all	Eat all
Ngetou Malick Junior man	Sell more than eat			Eat more than sell			Eat all	Eat all		Eat all			
Panal Senior man	Sell more than eat	Sell all	Eat more than sell	Eat and sell equally	Eat and sell equally	Eat and sell equally	Eat more than sell	Eat all	Eat all	Eat all	Eat all		Eat all
Ngetou Malick Senior man	Sell more than eat						Eat more than sell	Eat more than sell		Eat more than sell			

Figure 6.11: Reported SPL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.

The SPL residents of Panal report more livelihoods activities and crops on their fields than their counterparts in Ngetou Malick. This pattern shifts for animal ownership, with those in Panal and Ngetou Malick reporting the same average number of animals (2.0) (Figure 6.12). However, those in Ngetou Malick report an average of 1.6 draught animal types, while in Panal the reported number is 0.9, suggesting that those in Ngetou Malick have a wider variety of draught animals in their households. Those in Ngetou Malick also concentrate their animal ownership in other large animals like sheep, all with high value. Those in Panal report much lower rates of ownership for all animals except chickens, and they also exclusively report ducks, pigeons, and turkey. These are smaller animals with lower value. This suggests that those with SPL in Ngetou Malick have more secure access to adequate animal traction than those in Panal, and that they also have assets they can sell to address significant shocks or stressors. Those in Panal are substantially more constrained, as chickens and other poultry have less value, and are therefore less useful in dealing with shocks and stressors. Further, while all members of this group in Panal reported owning a draught animal, it is clear they own fewer such animals than their counterparts in Ngetou Malick, and are therefore more vulnerable to animal illness or death dealing a significant blow to their agricultural activities.

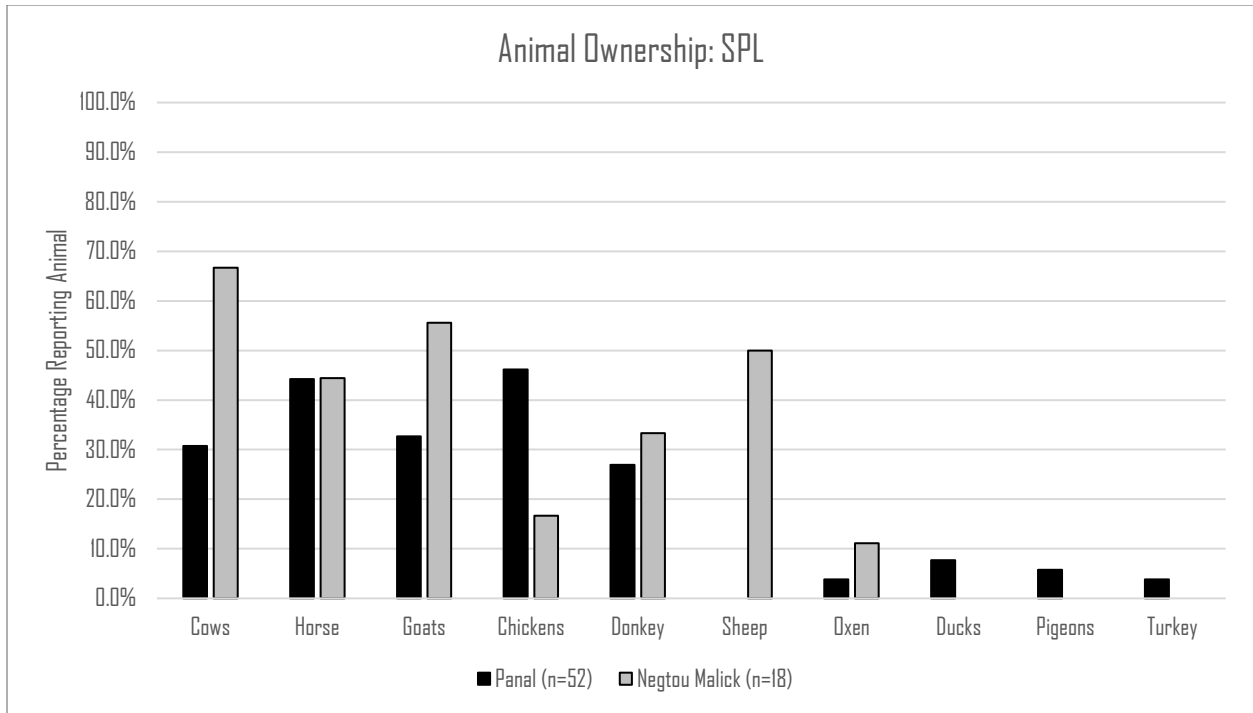


Figure 6.12: SPL animal ownership by village

When viewed through the lens of gender, seniority, and village of residence, SPL animal ownership displays a few patterns (Figure 6.13). Animals that can provide traction, like horses, donkeys, oxen, and cows are more commonly owned by men (the single Ngetou Malick senior woman claiming to own a cow could be reporting an idiosyncratic situation, and those in Panal report a much lower rate of ownership). Further, men own goats and sheep at much higher rates than women. Women tend to emphasize poultry in their ownership. This ownership aligns with the roles and responsibilities of men and women in this group, and in Zone SN10 more broadly, as women’s responsibilities center around domestic expenses and spaces, for which poultry often provide adequate income, but not enough income to accumulate larger animals. While there appears to be a small effect of seniority on the rate of men’s ownership of donkeys, where more senior men own more donkeys, there is no clear evidence of the impact of seniority on rates of ownership for other animals in this group.

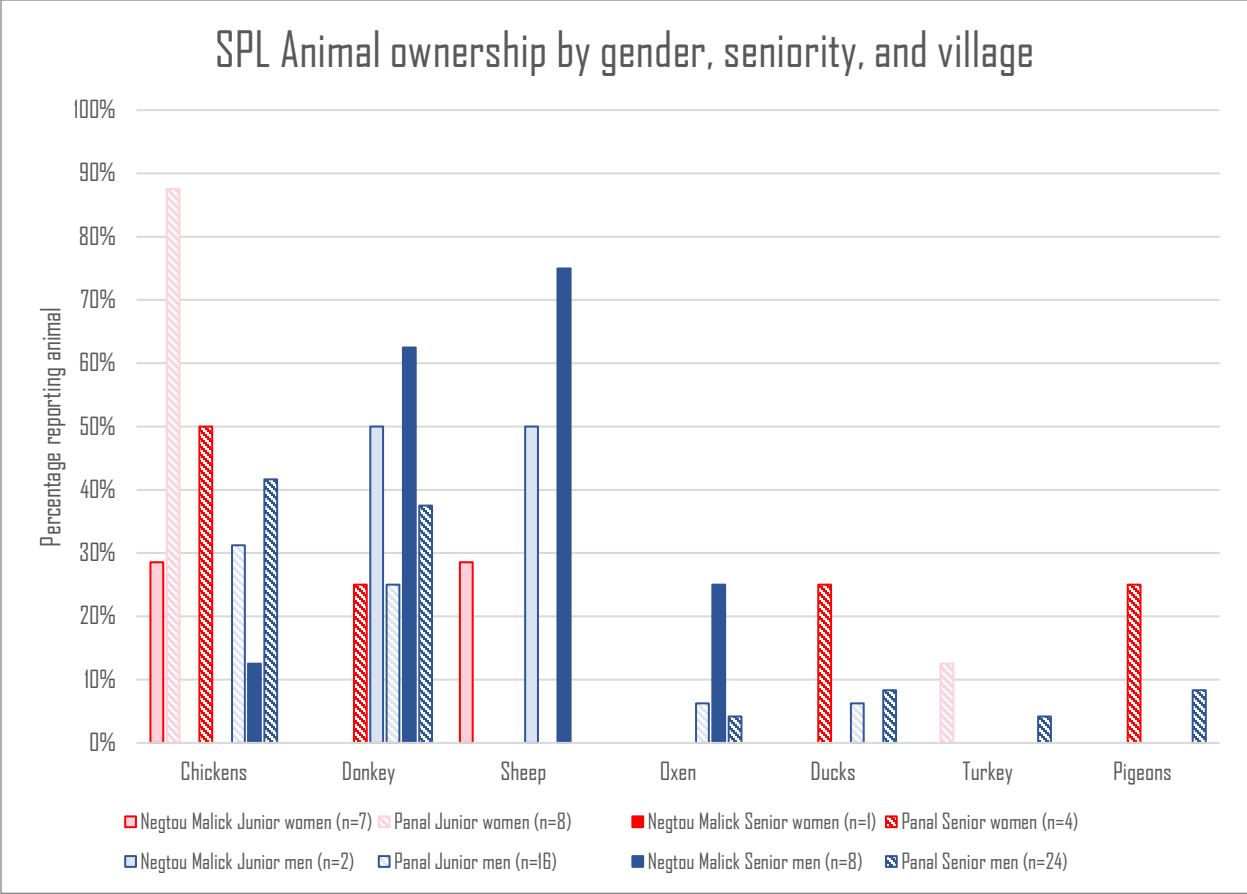


Figure 6.13: SPL animal ownership by village, gender, and seniority

In summary, the livelihoods of those with SPL are secure, incorporating substantial agriculture enabled by access to both draught animals and equipment, broad animal ownership, and some degree of nonfarm employment that diversifies their household situations. While those in Panal appear somewhat more secure in the diversification of their livelihoods and crops, they own fewer draught animals than those in Ngetou Malick and therefore their agricultural production is somewhat more precarious. Further, they own fewer goats and sheep with which to raise funds to address needs than those in Panal, depending instead on lower-value poultry for this purpose. Again, this leaves those with SPL in Panal in a more precarious position than those in Ngetou Malick, as they have to meet shocks and stressors with smaller assets.

**6.2.2. Secure Subsistence Livelihoods**

Those with secure subsistence livelihoods (SSL) do not have the access to equipment and animals seen among those with SPL, and as a result they are not assured of a surplus, even in a good year. Members of this group expect to achieve subsistence each year. Doing so usually requires borrowing money or selling off livestock, but members of this group are generally confident in their ability to cultivate enough crops to pay this money back or re-purchase the animals after harvest and meet their subsistence needs year after year. Those with SPL in Panal report an average of 3.3 activities, while those in Ngetou Malick report 2.7. As with SPL, rainfed agriculture and animal husbandry are near-universal activities across those with SSL in the two villages (Figure 6.14). As seen with SPL, while those with SSL prioritize the same activities in the same order, residents of Panal report higher rates of participation in artisan/business activities, gardening, and wage labor. For those with SSL,



gardening is principally a means of augmenting household food, with surpluses sold for income. The vast majority of garden production is consumed in the household. Women in this group characterize their business activities as producing income for household purchases such as condiments and soap, while men see such activities as complementing but not displacing their agricultural efforts. In this group, business activities are focused on selling food and petty trading, both activities practiced exclusively by women. Men control a variety of daily labor and skilled jobs. For both men and women, these activities were supplemental to agriculture. One junior woman in this group described her porridge selling as a way to keep herself active in the dry season (PW08, see also PW10).

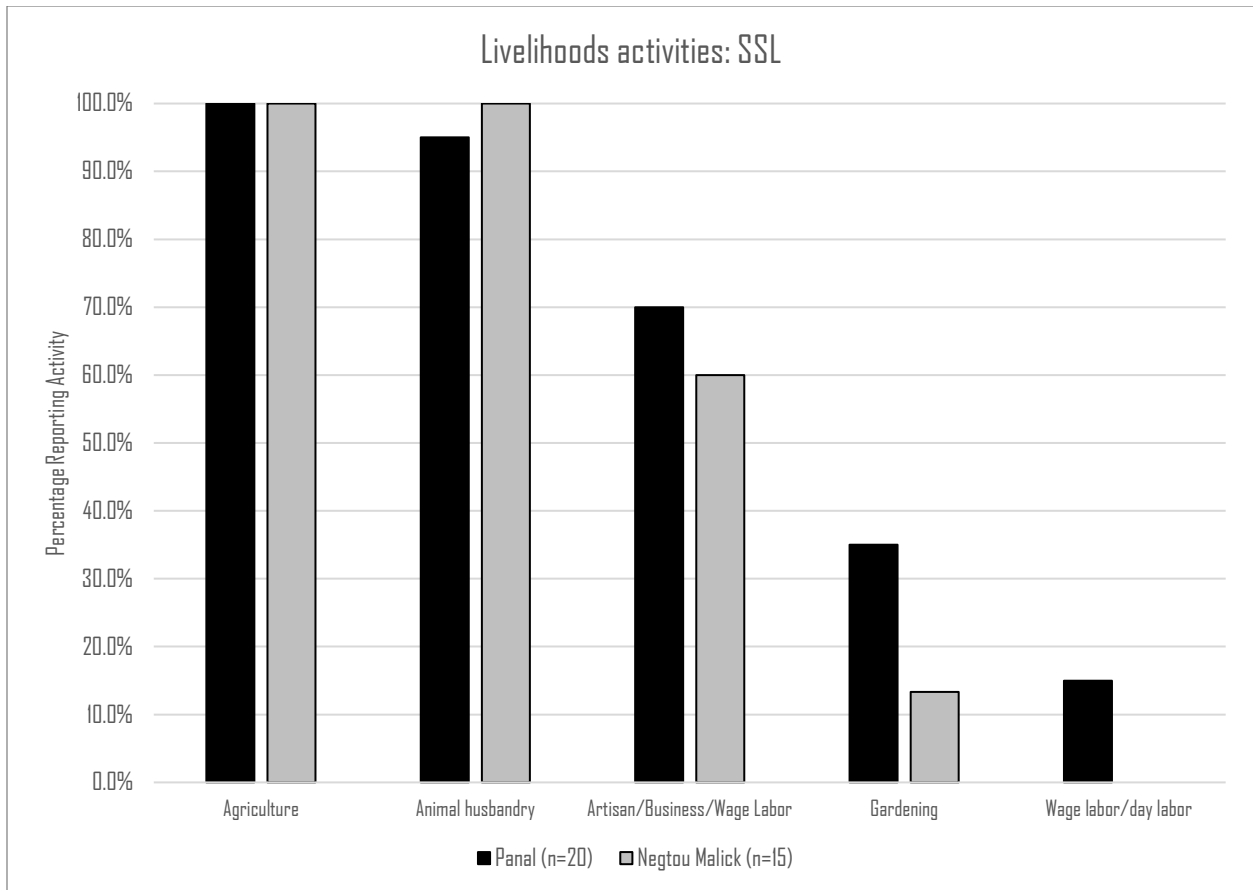


Figure 6.14: SSL livelihoods activities reported by village

The disaggregation of those with SSL by gender, seniority, and village of residents reveals few patterns of difference with regard to participation in livelihoods activities (Figure 6.15). Gardening is clearly associated with women, but business reveals no clear pattern of engagement across these identity categories. However, business activities are gendered in that the majority of activities reported by women in this category are food selling and petty trading, while nearly all men's activities are non-farm wage activities.

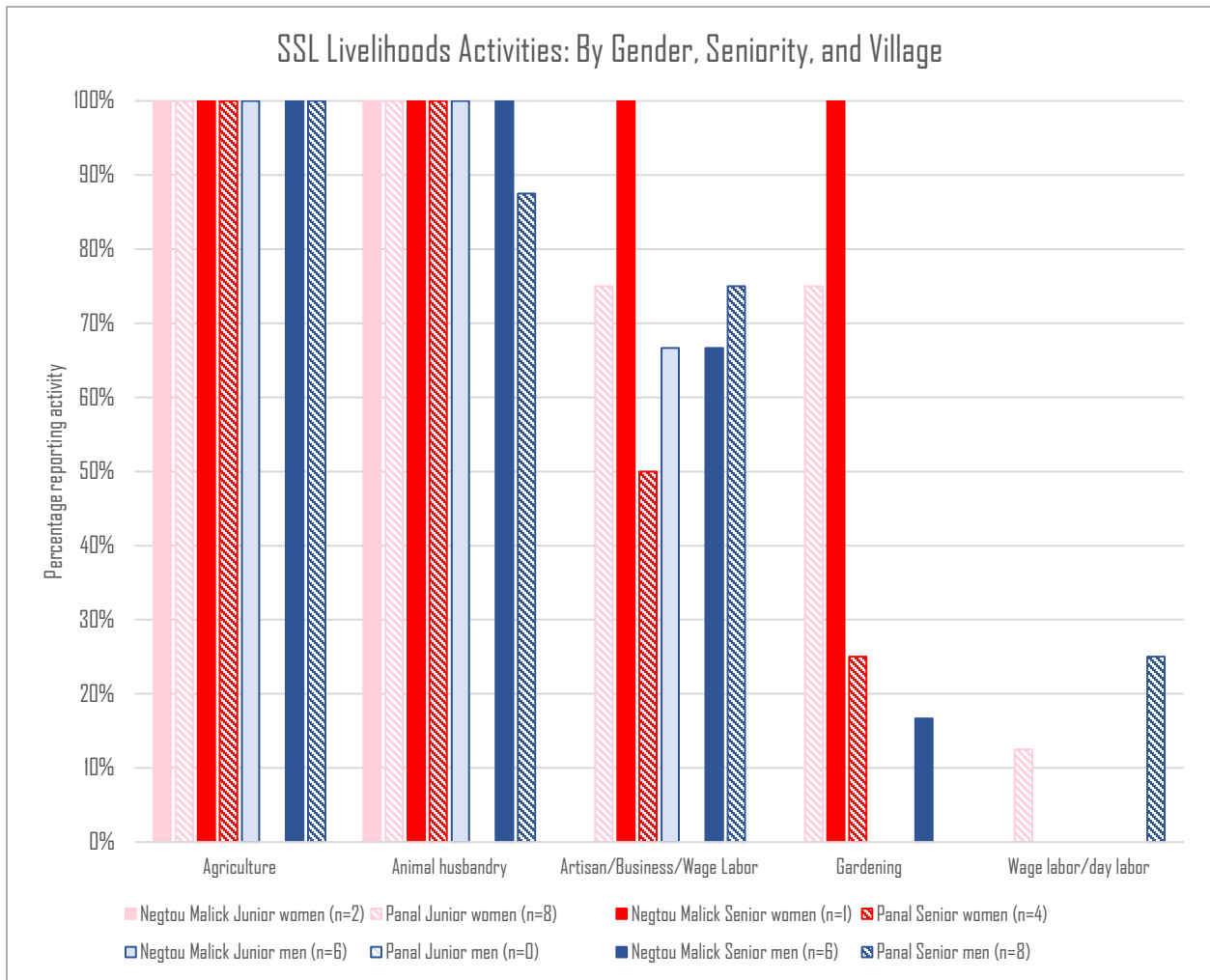


Figure 6.15: SPL livelihoods activities reported by village, gender, and seniority.

SPL rainfed agriculture centers on peanuts and millet in both villages (Figure 6.16). However, the patterns of cultivation diverge here, with those in Panal cultivating much more cowpea and hibiscus, while those in Ngetou Malick cultivate much more maize and sorghum. With regard to maize cultivation, this pattern reflects a significant dropoff from reported rates of cultivation among those with SPL in Panal. As maize requires more water than these other crops, it is a much riskier crop in this drier village, and as those with SSL do not have access to their own equipment, their agricultural preparations are often delayed. This means they have less of the season to work with, which compounds the risk of limited and variable rainfall that each season presents, making the crop unappealing in Panal relative to Ngetou Malick.

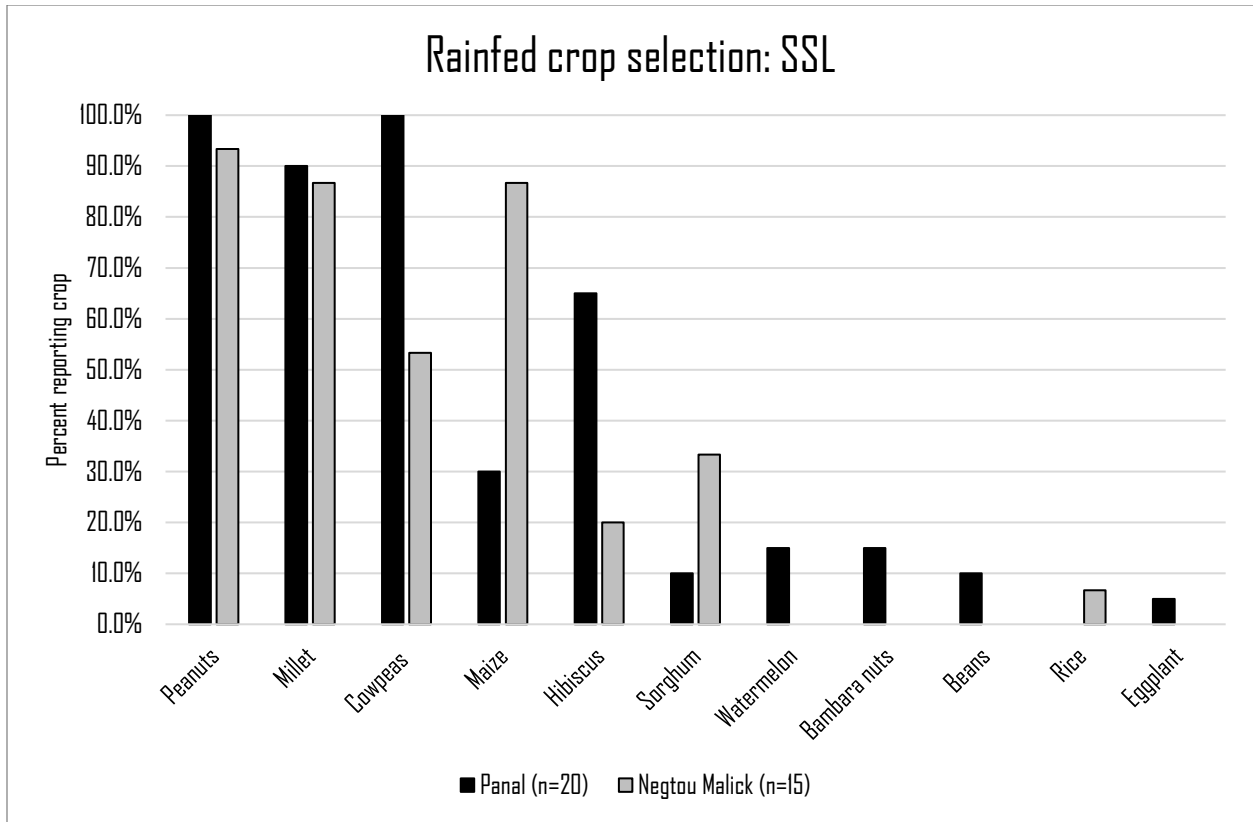


Figure 6.16: SSL crop selection reported by village

However, the differences in the crop selections and uses across those with SSL has significance beyond simple biophysical suitability. In both sites, cultivation is dominated by peanuts (most of which are sold). After peanuts, typically one other crop is cultivated both for sale and consumption. In Panal, this crop is cowpeas, while in Ngetou Malick the crop is sorghum. This shift is more significant than a crop selection appropriate to local context. Sorghum is nearly exclusively cultivated by men in this zone, while women dominate the production of cowpeas (Figure 6.17). This means that among those with SSL in Ngetou Malick, men control nearly all of the crop production aimed at significant cash income. Among those with SSL in Panal, men still dominate production for sale via peanut cultivation, but women play a significant role in obtaining cash through their cowpea production.

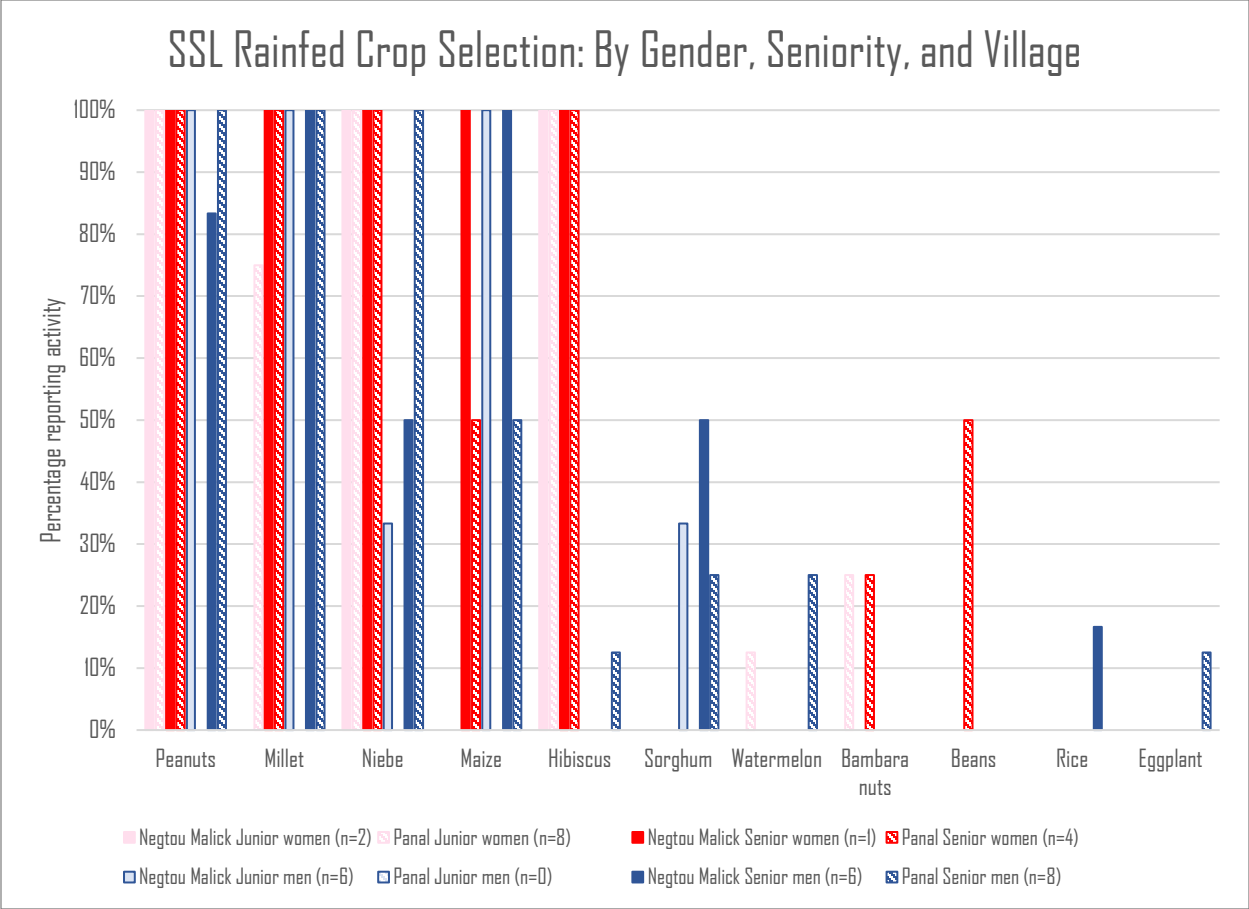


Figure 6.17: SSL crop selection by village, gender, and seniority.

The patterns of crop use among those with SSL (Figure 6.18) also suggest differences between this group and those with SPL. Overall, those with SSL generally value the consumption of their crops more than those with SPL. They not only identify more of their crops as subsistence (eat all), but also tend to view crops as having greater subsistence value than those with SPL. For example, men with SSL generally consume and sell their peanuts in equal measures, where men with SPL sell more than they ate. Much of this effect is likely produced by the amount of crop members of this group can cultivate, given they start cultivation only after those with plows can lend or rent them out after preparing their own fields. However, this does not fully explain the differences in crop use seen between these groups. For example, junior women with SSL sell more of their peanuts than they eat, while those with SPL reported eating as many as they sold. However, this difference likely reflects the fact that junior women with SPL often have the opportunity to convert low-value peanuts into peanut oil, which they sell at market. They may not be including this activity in their assessment of what they do with peanuts (eat versus sell), and thus be underreporting the market orientation of this crop in their livelihoods.

## SSL Crop Uses by Gender, Seniority, and Village of Residence

	Peanut	Sorghum	Bambara nuts	Watermelon	Chili pepper	Eggplant	Tomatoes	Cowpeas	Millet	Hibiscus	Okra	Maize	Pumpkin	Squash	Rice
Panal Junior women	Sell more than eat		Eat more than sell		Eat more than sell	Eat all	Eat more than sell	Eat and sell equally	Eat more than sell	Eat more than sell	Eat all		Eat all	Eat all	
Negtou Malick Junior women	Sell more than eat							Eat all		Eat all					
Panal Senior women	Sell more than eat		Eat and sell equally				Eat all	Eat and sell equally	Eat more than sell	Eat more than sell	Eat all	Eat all	Eat all	Eat all	
Negtou Malick Senior women	Sell more than eat							Eat all	Eat all	Eat all		Eat all			
Negtou Malick Junior man	Eat and sell equally	Eat more than sell						Eat all	Eat all			Eat all			
Panal Senior men	Eat and sell equally	Sell more than eat		Eat more than sell		Sell more than eat		Eat and sell equally	Eat more than sell	Eat all		Eat all		Eat all	
Negtou Malick Senior man	Eat and sell equally	Eat more than sell						Eat all	Eat all			Eat all			Eat all

Figure 6.18: Reported SSL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.

The patterns of animal ownership among those with SSL are broadly similar to that seen among those with SPL (Figure 6.19). Those with SSL in Panal report owning an average of two types of animal, while those in Ngetou Malick own 1.8 types. The differences in SSL animal ownership between these villages is also very similar to that seen among those with SPL. Those in Ngetou Malick own far more types of draught animal (an average of 1.5 types) versus those in Panal, who own only 0.9 types of draught animal. This suggests that SSL agricultural production is more secure in Ngetou Malick than in Panal, as farmers in Ngetou Malick have more, and more diverse, draught animals. This allows them to both work faster once they obtain a plow, and to weather species-specific shocks that might kill or sicken one type of draught animal while leaving the other untouched. Those with SSL in Ngetou Malick also own more sheep, an animal that can be sold for needed money, or used in ceremonies to build up the owner's status. Those in Panal report much higher rates of chicken and other poultry ownership than those in Ngetou Malick, but poultry is much less valuable than draught animals and sheep.

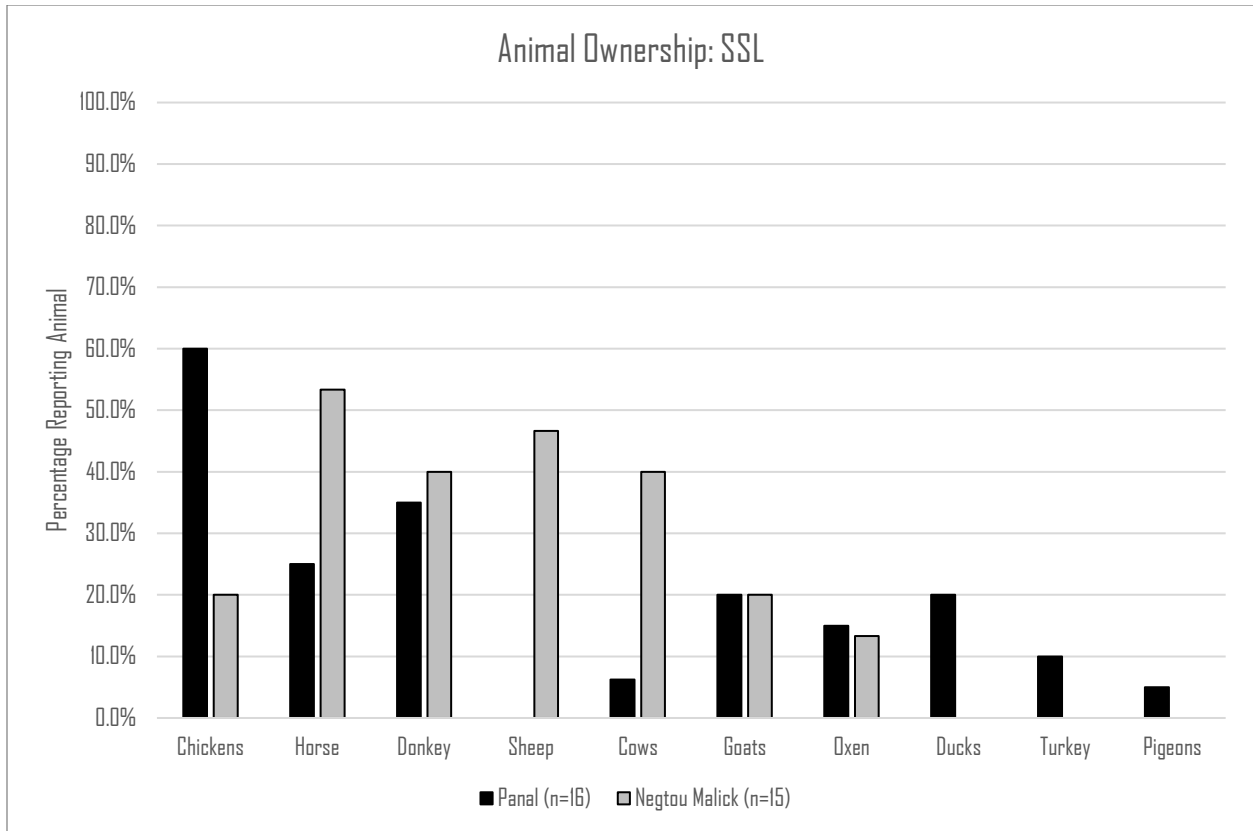


Figure 6.19: SSL animal ownership by village

There are gendered patterns of animal ownership broadly consistent with those observed among SPL residents (Figure 6.20). Women report owning poultry at much higher rates than men. Men dominate horse, donkey, and to a lesser extent goat ownership. Thus, women in Panal own a significant number of the animals in the village, though these animals are of relatively low value. Again, this aligns broadly with gendered roles and responsibilities in this zone. The figure also illustrates that senior men report higher rates of ownership for donkeys, sheep, cows, and goats, suggesting that seniority has allowed these men to store their earnings from previous harvests in these animals as a form of banking.

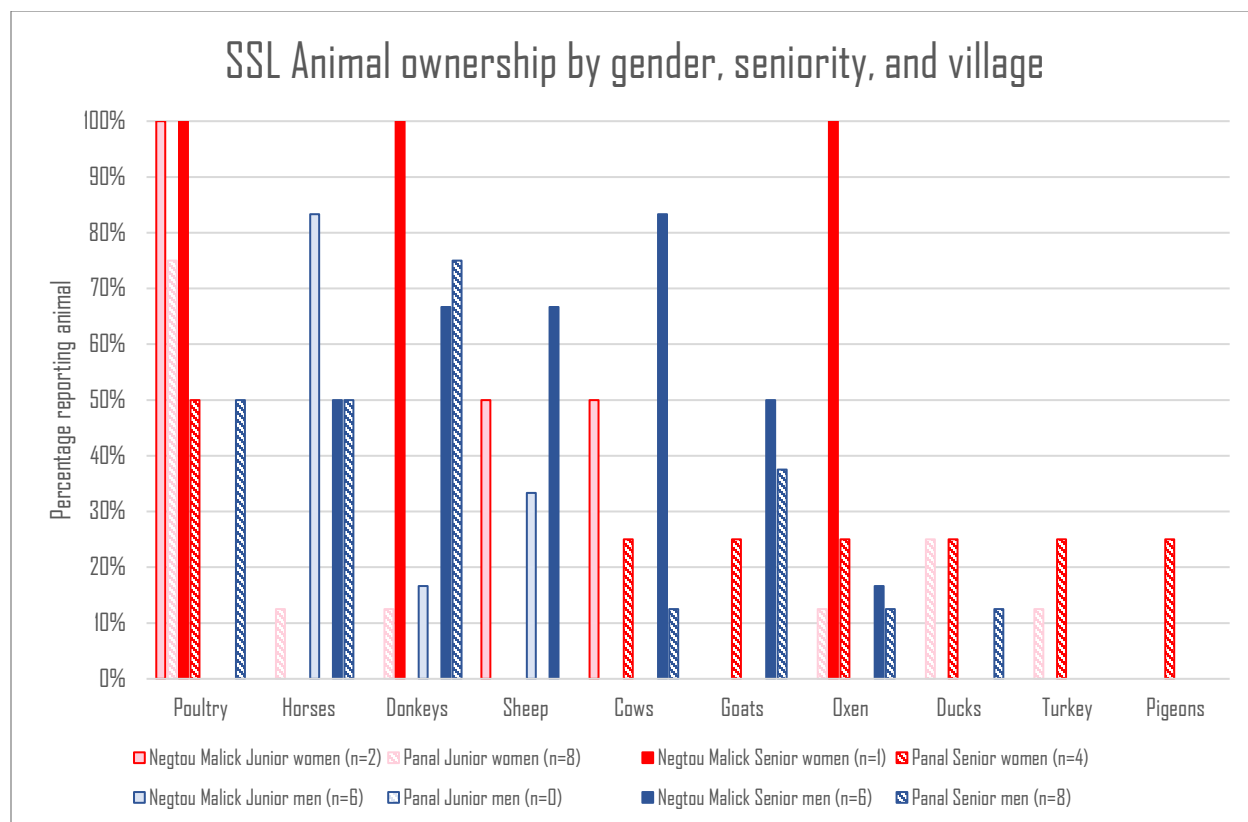


Figure 6.20: SPL animal ownership by village, gender, and seniority

In summary, those with SSL are likely to earn their subsistence each year, but make crop selections that speak to their limited access to farming equipment and therefore manage the risks created by their inability to plant right at the start of what is already an uncertain season. As the differences in crop selection between Ngetou Malick and Panal show, this is a group whose livelihoods outcomes are very sensitive to environmental conditions. As a result, they tend to favor crops that weather limited precipitation well, such as millet, and are more likely to eschew maize as conditions get drier and more precarious. They own draught animals, but the average farmer owns fewer types than those with SPL, rendering their agricultural production precarious, as the death or forced sale of a single animal could compromise their agricultural outcomes. As a result, they engage in a wider range of livelihoods activities than their SPL counterparts, as this income is a critical means by which they can manage shocks and stressors, and make ends meet each year, in the absence of secure surplus agricultural production or large animal holdings.

### 6.2.3. Limited Resource Livelihoods

Those with LRL are the most challenged members of both communities. The sampling of this group presents some challenges, because it is dominated by women who are either unmarried or divorced, or who live in households where their husband does not own draught animals or plows, but we only have one interview with a man from this group. However, as we demonstrate below, because we know the broad contours of the discourses of livelihoods in this zone, and the roles and responsibilities of men and women, we can still speak to what men are doing via the decisions and activities of their wives.

This group lacks both draught animals and key farming equipment, like plows. These circumstances make the timing of their agricultural production a result of the decisions and activities those who own both and can lend or rent out those animals after completing their own agricultural work. Agriculture is viewed as a source of food, fodder for animals, and income that is principally focused on reinvestment in agriculture and animals. The fact that those with LRL have lower rates of animal ownership than any other group, particularly in Ngetou Malick, suggests that this income is not large enough to allow for accumulation of assets. Residents of Zone 10 with LRL also participate in fewer activities than any other group. The average LRL resident of Panal reported an average of 3.0 activities, while in Ngetou Malick the average was 1.8. After agricultural production, business activities were the most commonly reported activity among those with LRL (Figure 6.21). These activities centered on the preparation and sale of food in the village and petty trading. The income from these activities was used to diversify household diets, and to meet household needs. For example, one senior woman in this group noted that trade allowed her to access fresh fish and to pay for her daily expenditures (Interview PS60). Most members of this group reported difficulties accessing credit, requiring them to self-finance the activities in each agricultural season. In the absence of significant animal assets that can be sold to raise the money needed for these activities, nonfarm income is a critical means of enabling basic activities like agriculture.

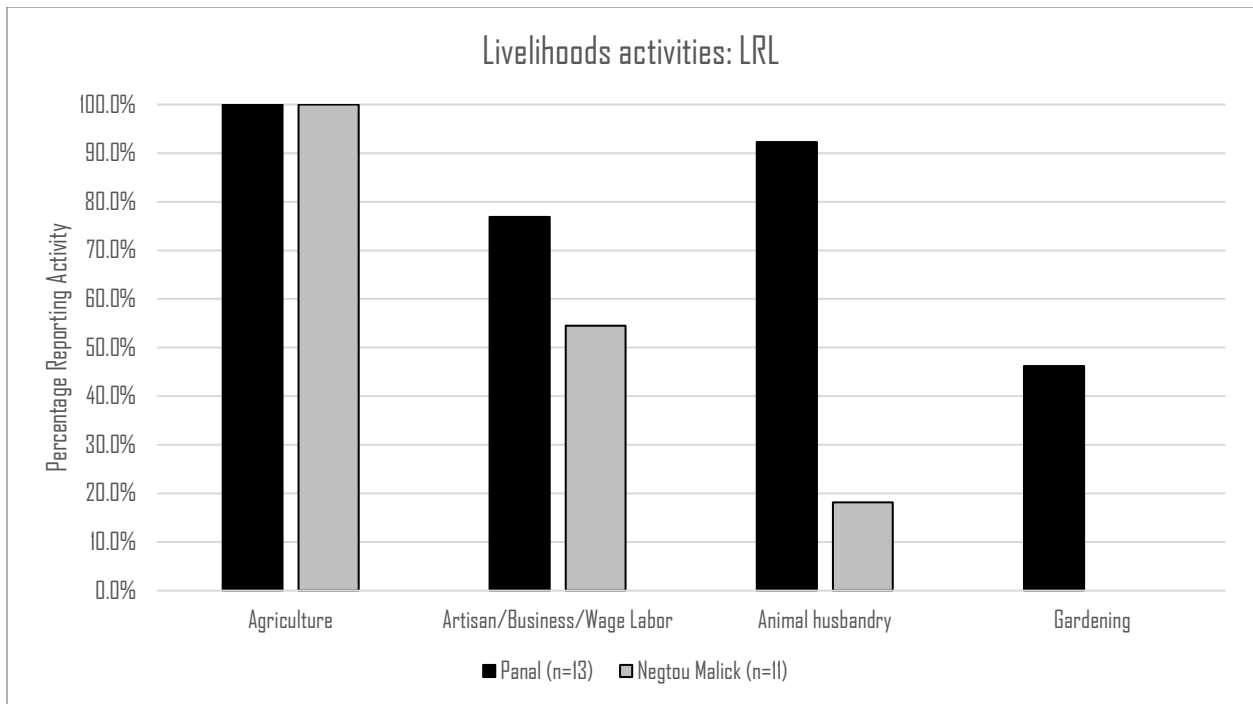


Figure 6.21: LRL livelihoods activities reported by village

While agriculture was a universal activity among those with LRL, among women seniority appears to play a role in the rate of participation in animal husbandry, with senior women reporting much higher rates than junior women (Figure 6.22). There is no other clear pattern of participation in this group.



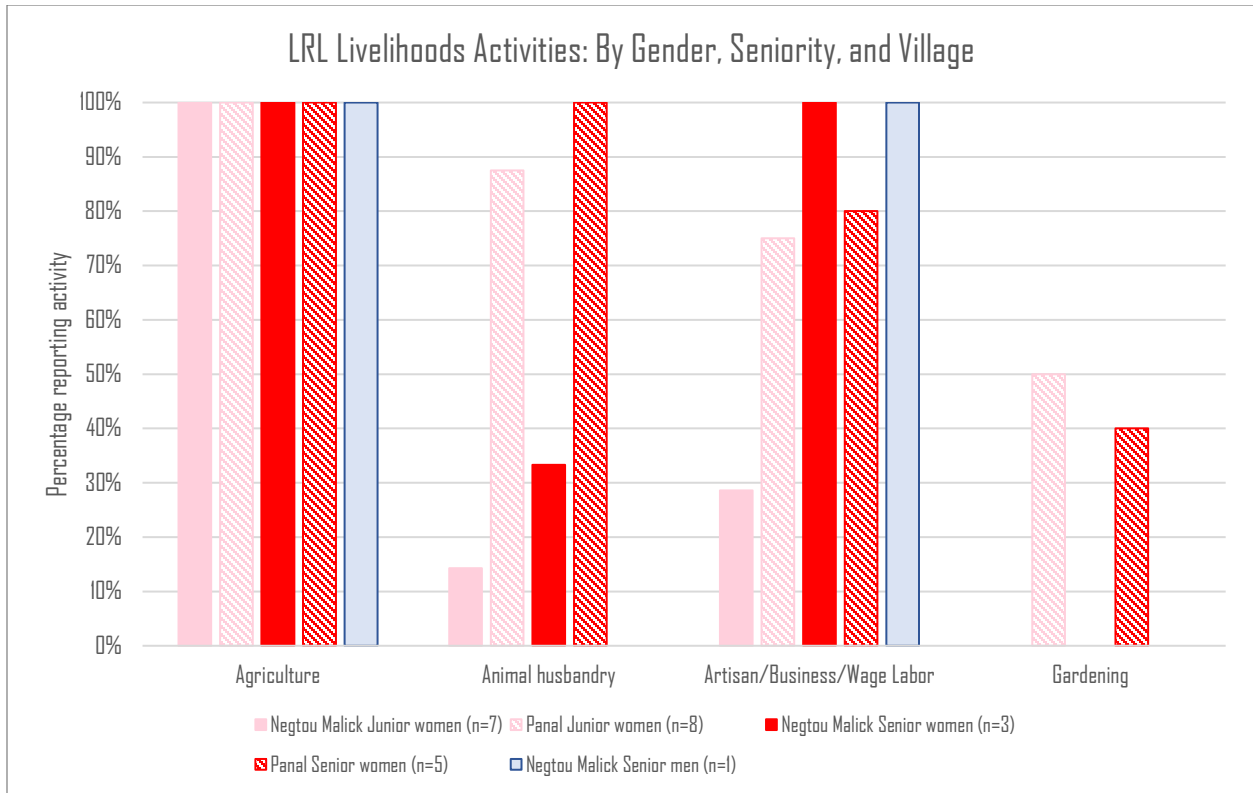


Figure 6.22: LRL livelihoods activities reported by village, gender, and seniority.

The rainfed crop selections of this group reflect both their stressed situations, particularly their lack of control of the timing of their agricultural production, and gendered expectations of agricultural strategy (Figure 6.23). They cultivate a smaller average range of crops than any other group (3.8 in Panal, 3.0 in Ngetou Malick). While peanuts remain the most commonly-cultivated crop, the members of this group emphasize drought-resistant crops like cowpeas, hibiscus, and millet, while eschewing the more water-sensitive maize. Further, cowpeas and hibiscus are widely viewed as women's crops. As women dominate those interviewed in this group, it is not surprising to see these crops cultivated in large amounts.

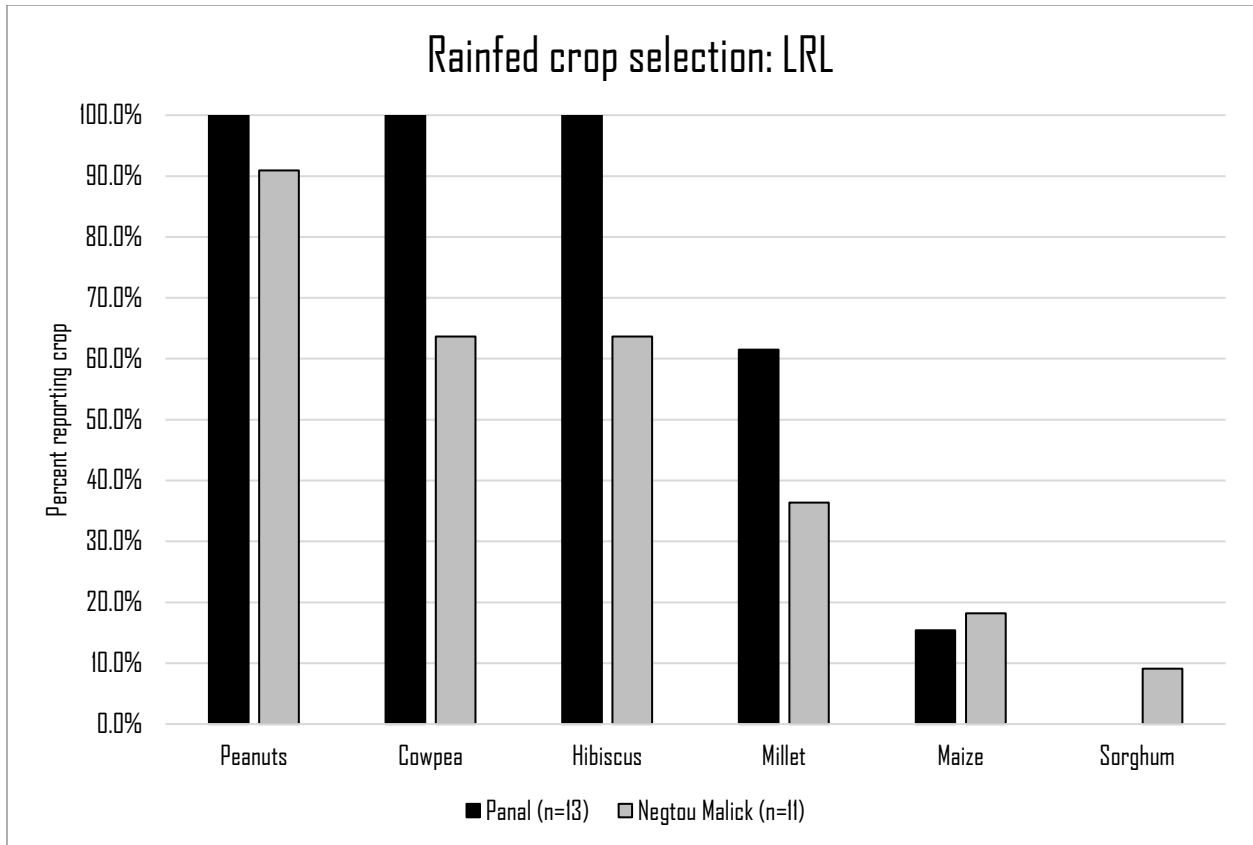


Figure 6.23: LRL crop selection reported by village.

The breakout of crop selection by gender and seniority shows one pattern: senior women are more likely to cultivate millet, cowpeas, and hibiscus than junior women (Figure 6.24). That any women cultivate millet is interesting, as this is generally seen as a man's crop. Some women in this group are more likely to cultivate millet because, for those who lack a husband, this production is not seen as usurping a man's production. However, many women in this group are married but still cultivate millet. It appears that the sanctions aimed at women who cultivate a "man's crop" are very weak. One junior woman said that she did not farm millet because she lacked the acreage and physical strength to do so, but nothing would happen to her if she did cultivate them (Interview PN50, see also PS84, PS54, PS60).

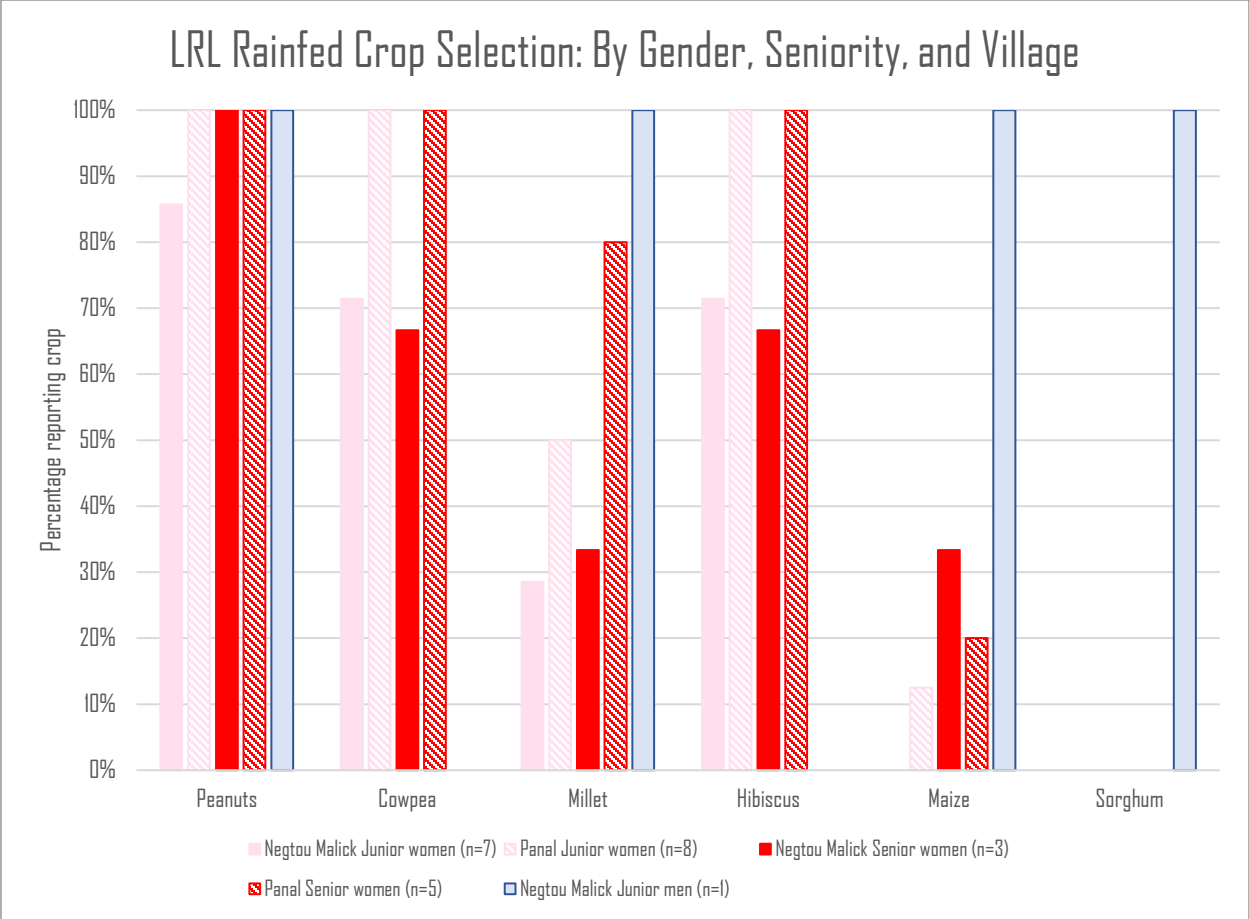


Figure 6.24: LRL crop selection by village, gender, and seniority

The expected uses of rainfed crops are very similar to those with SPL, and slightly more market-oriented than those with SSL (Figure 6.25). The interviews suggest that agricultural incomes in this group are small. For example, no member of this group mentioned using farm income to buy animals, buy farming equipment, fix their house, or even invest in their business activities. Instead, this income goes to buying food (rice and maize) for the household, paying school fees, and addressing short-term financial needs.

## LRL Crop Uses by Gender, Seniority, and Village of Residence

	Peanut	Millet	Eggplant	Tomatoes	Hibiscus	Cowpeas	Chili pepper	Maize	Okra	Pumpkin	Squash
Panal Junior women	Eat and sell equally	Eat more than sell	Eat all	Eat all	Eat more than sell	Eat more than sell	Eat all		Eat all	Eat all	Eat all
Ngetou Malick Junior women	Sell more than eat	Sell more than eat			Eat all	Eat all					
Panal Senior women	Sell more than eat	Sell more than eat	Sell more than eat	Sell more than eat	Eat more than sell	Eat more than sell		Eat all			Eat all
Ngetou Malick Senior women	Sell more than eat	Eat all			Eat more than sell	Eat more than sell		Eat all			
Ngetou Malick Junior man	Sell more than eat							Eat all			

Figure 6.25: Reported LRL crop uses by gender, seniority, and village. Darker colors represent a greater use of the crop for market sale. Blank cells either have no data, or represent crops not grown by that group.

Rates of animal ownership among those in households with LRL are extremely low (Figure 6.26). Those in Panal report an average of 1.6 types of animals, while in Ngetou Malick the average is 0.4, suggesting that most members of this group in that village do not own any animals. Across these villages, there is an absence of draught animal ownership in this group. Instead, animal ownership is focused on chickens and poultry, and a small number of goats. These are the lowest-value animals in these villages, and therefore of little utility in addressing the significant challenges these households face making ends meet each year, let alone addressing any shocks or stressors that might arise.

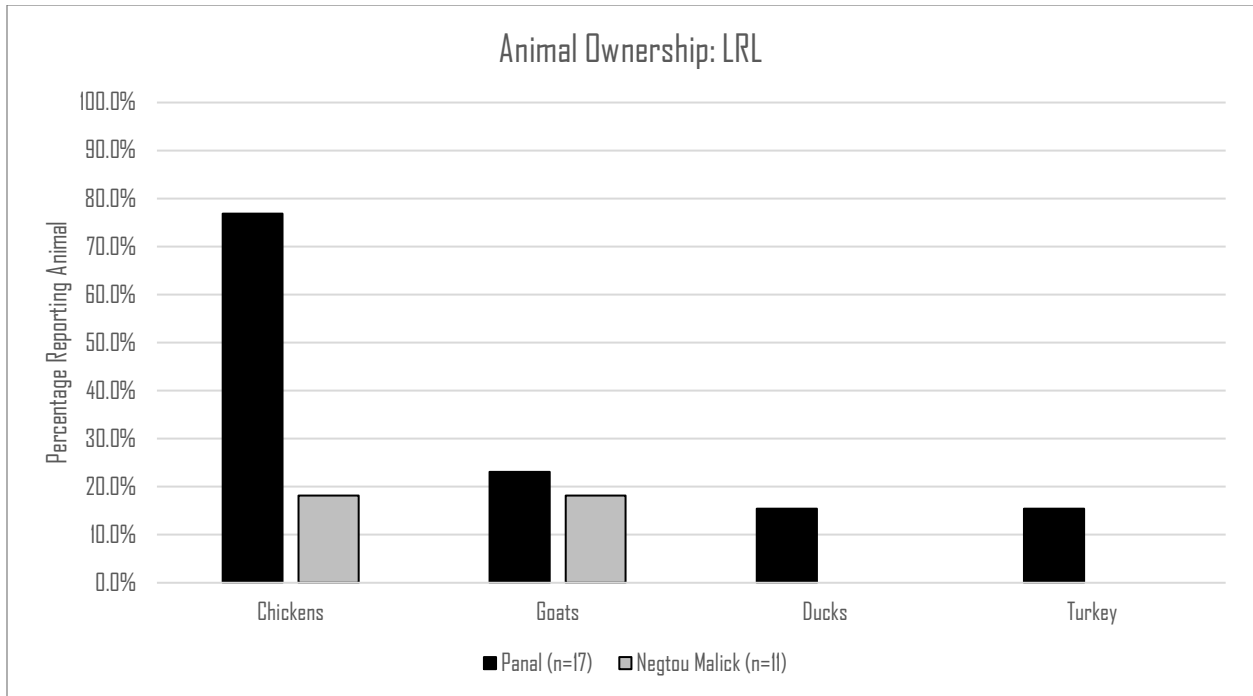


Figure 6.26: LRL animal ownership by village

The size of this group, and the very limited ownership of animals by its members, makes the identification of meaningful patterns of gendered and/or seniority-based ownership impossible (Figure 6.27). It appears that senior women own poultry at a higher rate than junior women, which suggests that junior women are likely the poorest and most vulnerable members of this group, and the larger communities to which they belong.

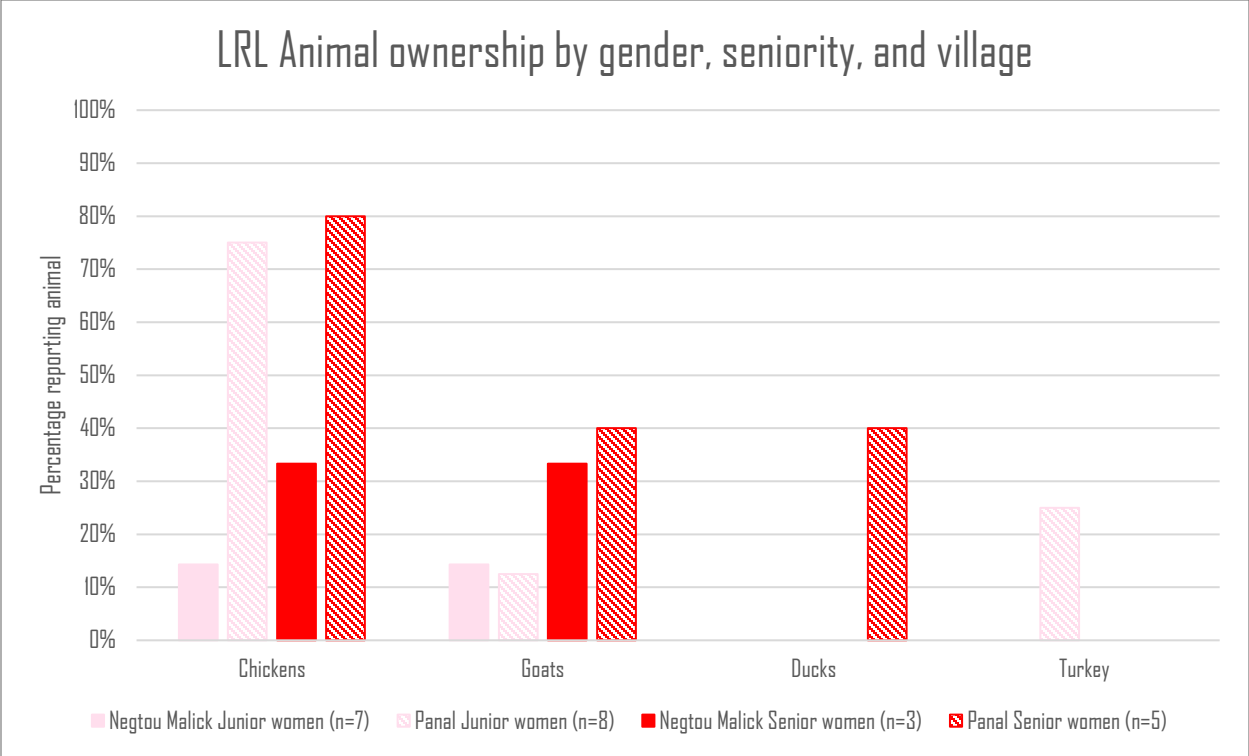


Figure 6.27: LRL animal ownership by village, gender, and seniority

**6.2.4. Summary**

The discussion of the discourses of livelihoods manifest in the words and decisions of those in each of the three vulnerability groups in this zone demonstrates that while all of those HURDL interviewed and observed live in the same livelihoods zone, they have very different experiences of that zone. These residents are guarding against different livelihoods outcomes (for example, a failure to increase production versus a failure to meet subsistence needs) and seeking different goals (expanded production versus secure subsistence). These differences, within households, across households, across communities, and across this zone, are not invisible to the residents. In the interviews, many residents lamented their inability to participate in activities that others used to secure their subsistence or generate profits. However, these complaints were rarely framed as something that was easy to address, for example via agricultural inputs, more credit, or more animals. Instead, residents seemed somewhat resigned to their challenges. Certainly, the social facts of life in this zone go a long way to defining what is seen as a challenge, and what steps one might take to address those challenges. However, social facts are not enough to explain the very high degree of conformance with expectations of roles and responsibilities seen across our sample in this zone. We must also look to the ways in which these roles and responsibilities are policed in this zone if we are to fully understand the barriers to climate information uptake and use experienced by different residents.

**7. TOOLS OF COERCION IN ZONE 10**

The intersection of social roles and responsibilities with what is deemed to be appropriate conduct of particular livelihoods activities in Ngetou Malick and Panal create a strong set of “social facts.” These social facts provide framings of the world that are seen to be valid and true and which set general boundaries for possible actions and thoughts in their everyday lives (Gidwani 2001, p. 79).

While these social facts provide a strong explanatory framework for the patterns of activity and behavior seen in these villages, they are not sufficient to explain the consistency of these patterns across the zone, across groups within communities, and across different individuals within those groups. This is particularly true because the livelihoods strategies that emerge from these social facts, while generally serving to produce pathways of material safety in an uncertain world, do not benefit all members of this zone equally. For example, in this zone men's agricultural production is more valued than that of women, and therefore men have priority when it comes to the use of draught animals and plows. While this prioritization speaks to the food needs of each household in this zone, later field preparation reduces the amount of time women's crops have to mature, reducing their harvests and any chance of cultivating a marketable surplus that might be used to meet their personal needs or aspirations. Women are aware of these unequal outcomes, and not always satisfied with the loss of opportunity in the name of household security. Yet women do not openly protest this prioritization, or adopt different activities or crops that might benefit them personally. To better understand outcomes such as these, and to understand the degree to which they might be malleable, we must understand how these social facts are policed. In every community there are certain tools of coercion, or specific means through which members of the community can correct and/or punish those that do not live up to the expectations emerging at the intersection of identity and livelihoods (Carr 2013, p. 84). These tools of coercion speak to these roles and responsibilities, and the extent to which the social facts of zone 10 are in question.

As demonstrated above, in Zone 10 livelihoods decision-making is largely contingent upon an individual's gender and the agroecological and market conditions of the community in which they live. The vast majority of the residents of this zone live in households with a single husband and one or more wives. In these households, men are in charge, making decisions about agricultural strategy, animal husbandry, and the use of household resources like income. In this Zone, men's authority is generally derived from their role as the head of the household, their experience in agriculture, livestock and financial management, and their control over draught animals and farm equipment (e.g. PN 009). One junior woman, the second of three wives in her household, clearly illustrates the importance of status around the head of the household, referring to her husband as "the chief of the household" who decides "when is the best time for planting" (NG04). However, men's experience is an important source of their legitimacy (PW07, PN029, PS41, PS51, PT045). For example, a widowed senior woman, who did not have to consult men in her agricultural decisions because she lived in her own household, noted that she preferred to consult with senior men for advice because "a senior man has more experience and will give good advice" (NG02). Men's role as head of the household and their experience with the activity or asset at hand were by far the most common justification for men's authority. Still, the fact men control plows and draught animals serves to reinforce the importance of their production. One senior woman explained that her husband makes "the decision about when do to these activities because he uses his animals and his farming equipment" (NG27, see also NG25, NG30, NG04, NG05, NG20, NG06, PN23, PN35, PN38, PS43, PW06).

Women in this zone have very little decision-making authority at the household level. Regardless of seniority, women are expected to accept the decisions of the men in their households with regard to agricultural strategy, finances, and livestock (PN34, PN44, PS58, PW04, PW18, PW28). This obedience extends to livelihoods decisions, such as the timing of plowing and planting (Interviews NG07, NG08, NG20), livestock decisions (Interviews NG04, NG05, NG08), and numerous other facets of daily life in the village. As one junior woman said, "it is not a married woman's role to make decisions when her husband is present" (PW10), while a senior woman said that her role is to

execute her husband's orders (PW04). Most men do not share any household decision-making responsibilities with his wife or wives. In the rare cases where men share decisions with their wives, they are never around agriculture but sometimes around finances (PW019) or livestock (PT065, PW019). In rare cases where a woman's husband is too old or busy to make decisions, women may make decisions about agriculture activities (PG073, PN050) or livestock (PN050, PT077, PW022).

Women who do not obey their husbands are subject to a bevy of possible sanctions. The most minor of these sanctions are related to social status. For example, a disobedient woman will be critiqued by others in the village (Interviews NG18, NG25, NG26, NG28, NG34). Her husband or others in the village will also resort to treating her like a child (Interviews NG13, NG41, NG42), will lose respect for her (Interviews NG4, NG8, NG16, NG19, NG24), and will talk down to her (Interviews NG4, NG6, NG7, NG15). Generally, when small instances of disobedience occur, those in authority may negotiate with the offender to avoid greater conflict. For example, one senior man noted that if anyone objected to his decisions he would negotiate with them, and if they persist, he will let them go (Interview PN33, see also PN29, PP85, PT67). This alludes to greater sanctions, which can occur when someone accrues enough of these minor sanctions to produce more acute sanctions. For example, such women may no longer be delegated household responsibilities (Interview NG16). While this initially may sound like a light punishment, this means that these women will no longer serve any productive purpose to their family. Women who suffer this sanction leave their gender roles unfulfilled and lose social status in the village as a result of being women. Several men mentioned that being labeled a bad woman will negatively impact that woman's chances of being married, going so far as to say that nobody will wish to marry a bad woman (Interviews PN44, PW24, NG17, PT61, PW06, PW24). Given that women rely greatly on their husband's support in developing their own agricultural livelihoods and providing for their households, this is a very serious sanction. Bad women also are also subject to another marriage-related sanction, in that her husband will not ask her permission to marry another wife (Interviews NG17, PN49, PW18). Normally, men ask their wives permission to marry another wife to ensure that the wives will get along, so not engaging in that process has the potential to create great strife within the household. Finally, one junior woman noted that a disobedient woman, or one who otherwise fails to live up to expectations, will bring trouble to her daughters as "men avoid marrying her children, because they think 'like mother, like daughter'" (Interview PN34, see also PP90, PW06). In some cases, a woman's views may no longer be considered in the village (Interviews NG1, NG2). More serious social consequences include absolute isolation from peers, nobody wanting to work with them or assist them when they are in need, and exclusion from information about important issues in the village. One junior woman starkly illustrated how physical violence becomes legitimized as a tool of coercion for a woman who persists in problematic behavior when she noted that, for such a woman, "when her husband beats her no one helps her" (PW22).

Men in this zone have roles and responsibilities, and therefore expectations of their own to which they must answer. When they fail to do so, they face a set of sanctions very similar to those for women. The most minor of these sanctions are centered around the loss of social status as a result of appearing lazy when they refuse to do necessary farming work or other duties for the household (Interviews NG16, NG18). In such situations, people will lose trust in and respect for them (mentioned by 63% of all respondents in Panal and 25% of respondents in Ngetou Malick), people will critique them, they will gain a generally bad reputation in the village (Interviews NG16, NG42). According to one senior man, when dealing with a man that has not lived up to his responsibilities, "people will start to avoid him, nobody will be willing to help him when he is in trouble, he will become public enemy" (Interview NG12, see also PG75, PW03, PW18). The continuation of



problematic behavior brings more harmful and substantive sanctions into play. These include not being informed about important village issues (Interviews NG03, NG16, NG26, NG32, PS60, PN38), nobody wanting to be seen with or be friends with them (Interviews NG02, NG03, NG06, NG17, PG73, PN33, PS57, PT79), and losing access to livelihoods resources such as labor, land, and credit (Interviews NG06, NG11, NG30, NG32, NG43, PW18, PW19). For example, a junior woman noted, “A bad husband will not have a chance in the community. People will not collaborate with him: he will be isolated” (NG43) while a senior woman said “the other men in the village refuse to help him if he needs help plowing his fields or fencing his house” (PW18). Additionally, men whose social and material standings are impacted enough might further be disadvantaged by the fact that women will avoid them (Interviews NG09, NG12, PN40, PS54, PS58) and nobody will give them their daughters for marriage (Interviews NG02, NG22, NG32, NG33, PN44, PW08, PN21, PN23, PN29). If problematic behavior persists for long enough, a man can be forced out of the community. For example, one senior man noted that someone who transgresses “will be excluded, and people consider him to be a terrible person, in the long run, he will be forced to leave the village” (PW007).

Though residents discussed the sources of authority in their households and communities at length, and could describe the sanctions that would be applied to address transgressions, in doing so they also made clear the extent to which the social facts of life in Zone 10 make the contestation of authority difficult to imagine. For example, most residents interviewed referenced men’s role as the head of the household as the source of their authority, as opposed to men’s experience, intelligence, strength, or even ownership of key assets. This suggests that this role is deeply embedded in local understandings of how to live in these communities. Further, there is some evidence that such challenges are very unusual. For example, one man said that if anyone tried to contradict his decisions he would challenge them, “but this situation has never happened” (PW01). Therefore, while there is ample evidence for small disagreements and discussions that can be managed through conversation or minimal mediation via the family or community, there is little to suggest that significant contestation of the social order or its material outcomes is a common or significant event.

## **8. ASSEMBLAGES OF VULNERABILITY AND THE LOGIC OF LIVELIHOODS**

Having laid out the identities at play in Zone SN10, the discourses of livelihoods that mobilize aspects of those identities and essentialize individuals into particular roles and responsibilities, and the tools of coercion by which those discourses and identities are policed, we now turn to the explanation of the specific assemblages of vulnerability within each vulnerability group. As has been demonstrated above, while there is an expectation that seniority is a significant factor in the livelihoods decisions and outcomes of residents of this zone, the evidence suggests that seniority plays a much smaller role than expected. This is likely because, across the two villages, very few residents lived in concessions or other agglomerated agricultural production units. While such organizations are recorded among the Wolof, in this zone they are clearly unusual. Instead, most residents lived in households of a husband and wife/wives. Without the need for an intra-production unit hierarchy of decisions and authority that requires the nuancing of gender by another aspect of identity such as seniority, gender becomes the principle social factor shaping the observed patterns of livelihoods activities and assemblages of vulnerability. Further, the different agroecological context, along with different access to urban areas and markets, of the two communities contributes to different patterns. However, across villages and vulnerability groups,

there is a consistent framing of livelihoods that explains what people see themselves as vulnerable to, and informs who manages those vulnerabilities via what means.

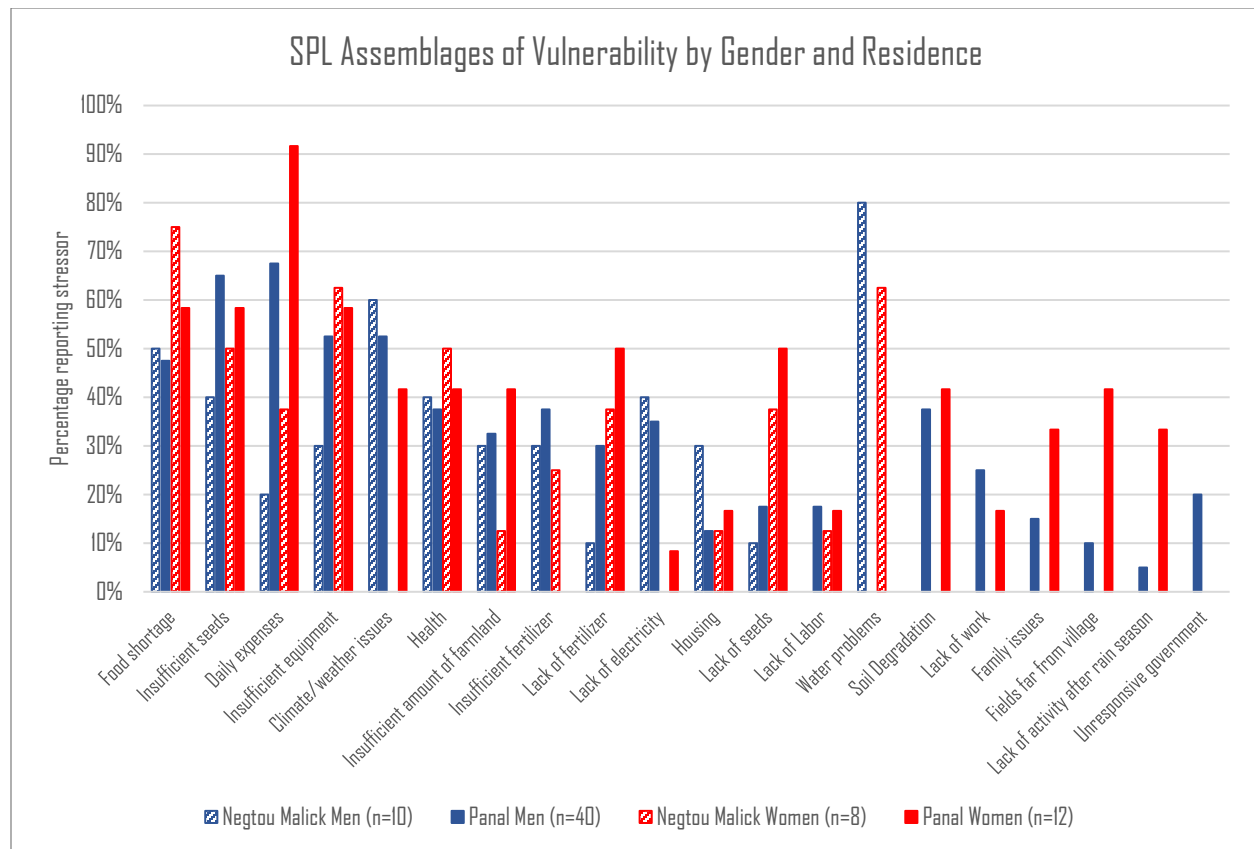


Figure 8.1: Assemblages of vulnerability for those with SPL in Zone 10, by gender and village of residence

Those with SPL, whether in Ngetou Malick or Panal, are focused on the expansion of their production (Figure 8.1). They are, by local standards, asset-rich. They own their own agricultural equipment and draught animals, and own other animals that can be sold for temporary income should there be a shock that disrupts agricultural production. However, this broad description masks important differences in this group across the zone. First, in Panal, members of this group own draught animals, but typically own one type of draught animal, and often a single animal. Relatively few members of this group own goats and none own sheep. In this group the most commonly-owned animal is poultry. This means that while the agricultural production of those with SPL in Panal is currently secure and productive of surpluses, it is also precarious. Most of the members of this group in Panal are a single major shock from significant challenges. A disease epidemic that hits cows or horses would likely greatly reduce the agricultural production of many with SPL. Further, if there was a significant economic shock, those with SPL in Panal generally have poultry and their draft animals. If the sale of poultry did not raise enough income to meet needs, individuals and households might have to sell off their sole draught animal, thus compromising their production. On the other hand, in Ngetou Malick, the average member of the group reported an average of 1.6 *types* of draught animal. Therefore, for the majority of these farmers, a single epidemic might cost them one type of draught animal, but not deprive them of all draught power. This suggests that these individuals are not only producing surpluses now, but that production is less precarious in the

face of shocks. Further, they own a range of animals, and thus have goats and sheep that could be sold to address shocks, making it likely they could manage any costs without having to sell off their animal traction. Second, those in Panal are much more concerned about access to seeds and fertilizer than those in Ngetou Malick. This reflects a difference in the contexts of the two villages, where land is both more fertile and available around Ngetou Malick, as opposed to a concern for shocks and stressors. The consistent differences, across genders, of reporting for this concern between the two villages further suggests that even the relatively robust agricultural production of those with SPL is somewhat precarious in the northern and eastern parts of this zone.

Thus, underlying assemblages of vulnerability focused on the expansion of relatively robust production is a variable concern for the precariousness of that production. This is manifest in the crop selections of those in the two villages, and the fact that while the assemblages of vulnerability reported by those in both villages is strikingly similar, there is a clear difference in the reporting of concerns for daily expenses. Those in Panal plant a wider variety of crops on their farms, a strategy for managing environmental and economic risk by spreading it across a diverse set of crops with different environmental and market responses to shocks and stressors. The fact that those in Ngetou Malick heavily focus on peanut production, and report planting millet, maize, and sorghum in roughly the same proportions, suggests a reduced concern for the impact of variable and light precipitation on their production that might require diversification and a greater focus on drought-tolerant crops such as millet.

The fact that men and women in Panal are more concerned about daily expenses, which if not met through production have to be met through the sale of assets, than are those in Ngetou Malick suggests a concern for the precariousness of their production. It is important to note that this variable concern is not reflected in food shortage or health concerns, suggesting that their vulnerability context is largely oriented toward smaller, more transient and therefore manageable shocks and stresses that might create significant inconvenience, but not disaster. This interpretation triangulates with the fact that those in Panal take up non-farm employment at greater rates than those in Ngetou Malick, as such work provides income that can either be used to purchase needed animals, or to pay for costs associated with shocks and stressors, when they lack the animal assets to do so.

Within this broad pattern of opportunity and stress, there are also gendered patterns of livelihoods in this group. Women are more concerned with meeting daily expenses, a lack of fertilizer, and a lack of seeds, than men. The first of these relates to women's more direct responsibility for the outcomes of such expenses, such as food preparation and clothing children, while men bear an indirect responsibility to contribute the financial resources needed to meet those needs and thus are less directly engaged in the day-to-day work of meeting those needs. The concerns for seeds and fertilizer reflect the diminished importance of women's production in the overall agricultural livelihoods of this context. However, this also reflects the fact that women are seeking to increase that production, which in the realm of rainfed crops suggests some space to maneuver.

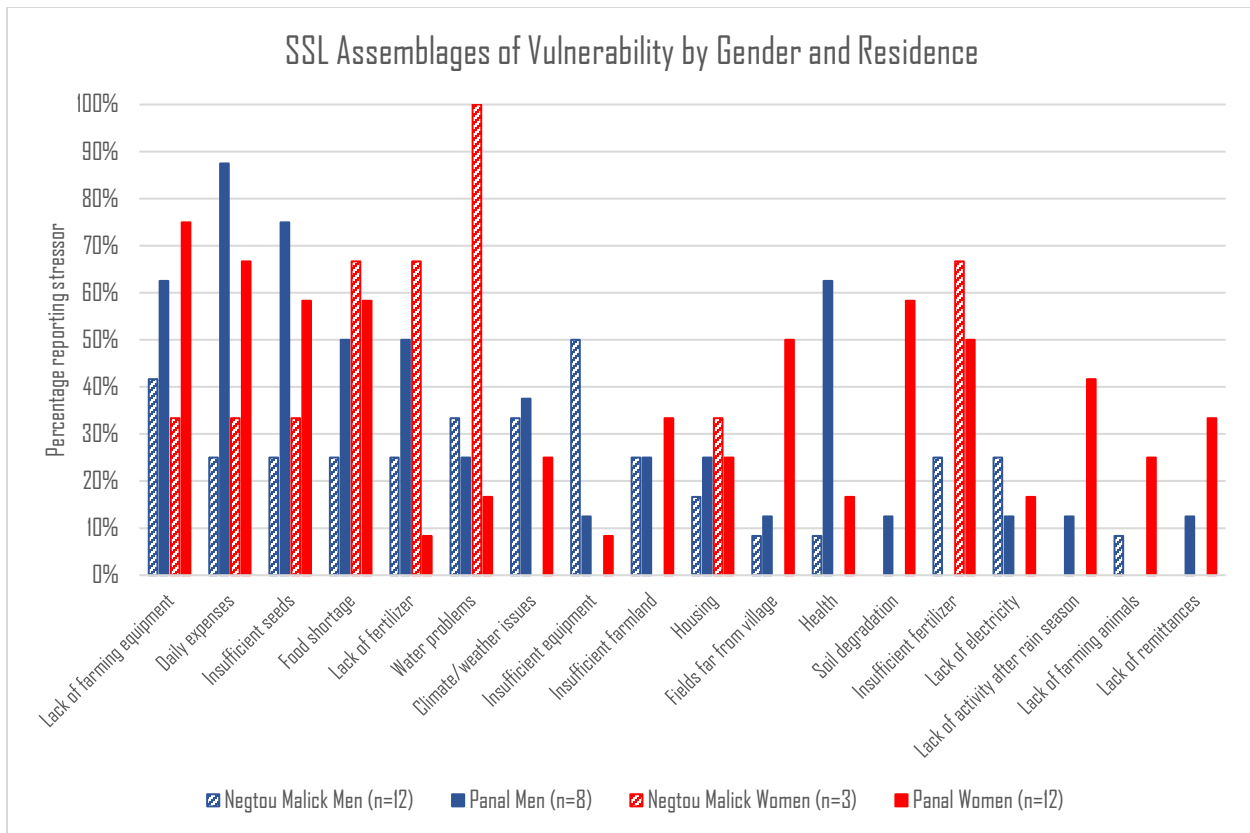


Figure 8.2: Assemblages of vulnerability for those with SSL in Zone 10, by gender and village of residence

Those with SSL live in households that generally have enough food and resources to meet their needs throughout the year, but may not regularly produce surpluses. Their production is hampered by the fact they do not own plows, and therefore have to wait to prepare their fields and plant. While all residents of Zone 10 are exposed to uncertain and variable precipitation each year, those in Panal generally see less precipitation than those in Ngetou Malick. As a result, the lack of farming equipment is a more acute stressor in Panal, as delays in the start of cultivation have greater consequences when overall precipitation in a season is lower (Figure 8.2). The reporting of insufficient seeds is principally focused on groundnut seeds, which are used for income and food (though a greater portion is sold than eaten). As seen among those with SPL, residents of Panal with SSL report much higher rates of concern for meeting daily expenses than those in Ngetou Malick. Those with SSL in Panal own an average of two types of animals, while in Ngetou Malick the average is 2.3. In Panal, the majority of these animals are poultry, which have less value than goats and sheep and therefore are less useful when addressing household needs, either when food supplies do not last through the new harvest, or if there are shocks that produce costs to be addressed. In Ngetou Malick, most of these animals are draught animals, with significant ownership of sheep and goats, and limited poultry ownership. Thus, those in Ngetou Malick have assets they can mobilize to meet their household's needs toward the end of the agricultural season when supplies run out, or if there are shocks that must be addressed, without compromising their agricultural production. Further, the average SSL farmer in Ngetou Malick owns twice as many types of draught animal as in Panal, rendering their sources of traction more resilient in the face of animal-specific shocks like disease. As a result, while all members of this group will share similar outcomes in a year without

shocks or unexpected stresses, under stressed conditions their fortunes can diverge rapidly. Those in Panal are therefore somewhat more defensively oriented in their livelihoods, as these shocks are likely to more quickly and more severely impact their livelihoods than among those in Ngetou Malick. In short, those with SSL in are somewhat more concerned with preventing a slide into LRL status in the face of shocks and stressors than they are with achieving higher material status, such as that seen among those with SPL. However, even this broad characterization obscures some slight but important differences across these two sites. In Ngetou Malick, the shocks and stressors emphasized reflect a desire to move their situation more toward that of SPL households, and less of a concern that shocks and stressors might induce a slide in overall conditions. It is not surprising, then, that those in Panal are on the whole more concerned about health issues than those in Ngetou Malick: a health shock is exactly the sort of event that could quickly reduce the assets and agricultural production of those in Panal, negatively impacting their overall livelihoods. In Ngetou Malick, there is less concern that a single health shock could compromise overall livelihoods, as there are assets on hand to address such a shock. At the same time, those in Ngetou Malick are more concerned about access to fertilizer than those in Panal, despite the fact that those in Panal express greater concern for soil degradation and land access, because they are trying to *expand* their production and move toward SPL status. In this group, women in general are more concerned about access to fertilizer than men because men allocate less fertile land to women.

There are significant patterns of gendered difference among those with SSL, but these too play out differently in the different parts of this zone. In Ngetou Malick, women are more concerned than men about meeting daily expenses, but in Panal men are more concerned about this issue. This highlights a different kind of stressor in place in Panal, one where men in this group have greater difficulty living up to their roles as providers for their households on a year-to-year basis. As this failure generally does not induce crisis, women are somewhat less concerned about this issue than the men, as the real threat here is more one to men's status than to women's or the household's material well-being. This is also why men and women report nearly the same rate of concern for food shortage in Panal, while in Ngetou Malick men are much less concerned than women about this stressor. In Ngetou Malick, men with SSL are much more confident in their ability to feed their families for the year, while in this responsibility is always precarious and subject to multiple points of failure. The fact that only half of those with SSL living in Panal report this stressor suggests that actual food insecurity is not pervasive in this group, but instead evidence that men's responsibilities, and therefore their role and authority, are more challenged by the local context than in Ngetou Malick. Lack of fertilizer also fits this gendered pattern. In Ngetou Malick, lack of fertilizer is a concern much more common among women than men, and reflects the fact that these women wish to augment their production, while men have enough access to fertilizer to confidently meet their food production responsibilities. Very few men with SSL in this village report concerns for insufficient fertilizer either, as this is not the principle barrier to increasing their production. Until they own plows, fertilizer will not be of as much use. In Panal, men are much more concerned about a lack of access to fertilizer than women, because they are concerned with cultivating enough food to feed their families and live up to their responsibilities. None of these men reported a concern for insufficient fertilizer because they are focused more on achieving subsistence than they are cultivating larger surpluses. Women with SSL in Panal, on the other hand, report insufficient access to fertilizer at a much greater rate, suggesting a desire to augment their agricultural production. This suggests that there is tension in these households around agricultural production and gendered roles and responsibilities, as women are seeking to increase their production in a context where men's production is precarious and may not live up to expectations. This pattern is not simply explained by

women stepping up to augment household production, as to do so would call the role of their husbands into question and creates a new set of intra-household challenges.

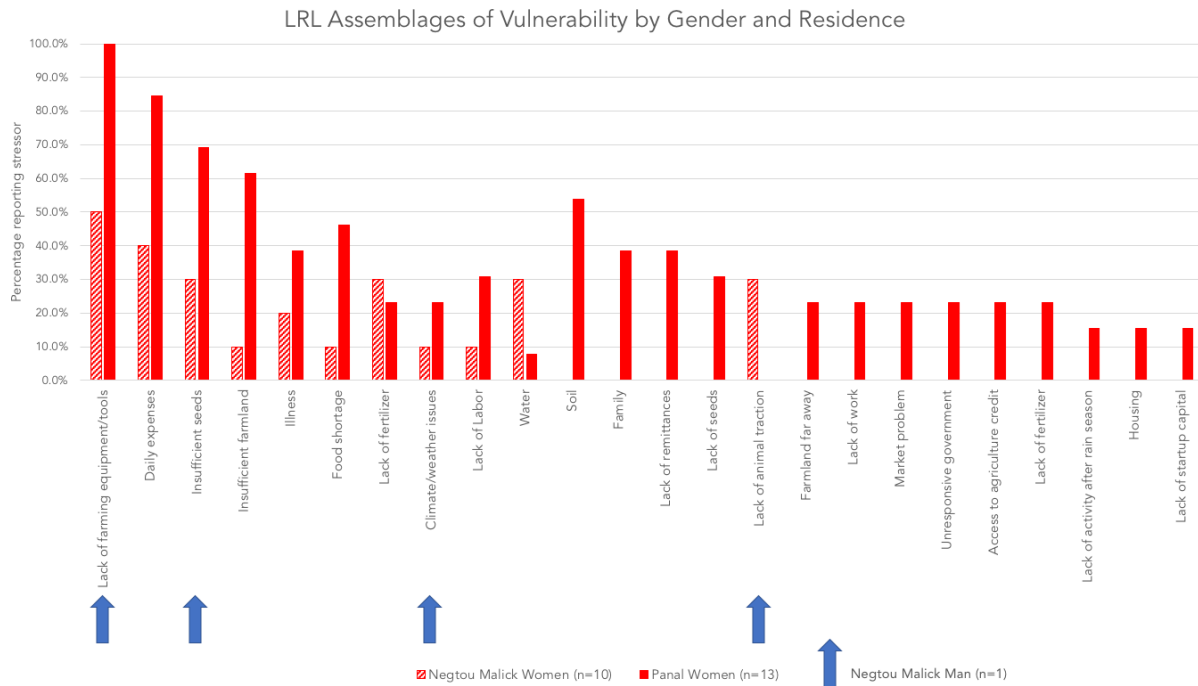


Figure 8.3: Assemblages of vulnerability for those with LRL in Zone 10, by gender and village of residence

In the samples interviewed in Ngetou Malick and Panal, only one man reported living in an LRL household. All other members of this group were women. Most were married to men that did not own animals or equipment, though one was a widow. The field teams did not encounter any of these men in their sampling, and did not interview the husbands of these women. As a result, we do not have a great deal of information about the men that belong to this group. Four stressors reported by the junior man in this group (from Ngetou Malick) intersected with those reported by the women in this group (Figure 8.3). This man also reported insufficient access to fertilizer. These stresses suggest that this man, at least, has significant concerns with meeting the material needs of his household each year, which constitutes a social and a material failure. In this group, however, such concerns are prevalent across genders and villages. Women in Panal report stressors at higher rates than women in Ngetou Malick, which reflects the somewhat more favorable agroecological context of the latter village. However, as these women emphasize threats to subsistence regardless of their village of residence, there is little to suggest that those with LRL are expressing concerns for barriers to increased production, and thus barriers to the improvement of their situation. Instead, their vulnerability context reflects highly defensive livelihoods. Animal ownership is very low among those with LRL, though in Panal this group reports significant poultry holdings. While these are of low value, the majority of those with LRL in Ngetou Malick reported no animal ownership, and only 18.2% owned a goat or a chicken. Therefore, whether in Panal or Ngetou Malick, those with LRL live under very precarious material situations. Their agricultural production is compromised by a lack of animal traction and farming equipment (especially plows), making them unlikely to cultivate enough food each year to feed themselves and their families. Further, they have few assets upon which to draw should they be hit with a shock. Those in Panal report significant engagement with

non-farm employment, which provides income that might address seasonal food shortages when their limited harvests run out before the next harvest, and might serve to offset the impacts of shocks. In Ngetou Malick, there is very little engagement with such activity, leaving this group particularly vulnerable to shocks and stresses.

While we have little evidence for men's assemblages of vulnerability in this group, the echoes of their stresses are visible in the data. For example, women in this group report the lowest rate of millet cultivation of any group (only one woman with SPL in Ngetou Malick reported cultivating millet, but this was a very small sample size and offset by high rates of cultivation by SPL women in Panal). Millet is often viewed as a man's crop, and while this view is somewhat contested, women's cultivation is acceptable principally if they cannot obtain peanut seeds. All of the women in this group report cultivating peanuts, which suggests that they do not have a clear justification for planting millet. But this is true in every other group in this zone. The lower rate of millet cultivation in this group instead suggests an outcome of men's efforts to manage their households while operating under stress. In other context in Sudanean West Africa, there is evidence that in households under stress, social roles and responsibilities are often policed more rigorously than in settings or households where there is little stress and the roles of heads of household (or those otherwise in positions of authority) are not in question (Carr, Onzere, et al. 2015). Thus, women with LRL are more discouraged from planting millet than women in more secure households.

## **9. CLIMATE SERVICES IN ZONE SN10: EXPLAINING CURRENT UPTAKE**

When HURDL conducted fieldwork in Ngetou Malick in 2013, it selected the village specifically because it had not yet been engaged by the MWG project. The goal of that project was to understand who the users and needs of climate information in Kaffrine were, and identify what information they needed, to inform the ongoing design of the project that became the MWG project. Anecdotally, some of HURDL's work filtered into project design, as the CCAFS impact assessment notes "the program also paid special attention to gender issues following a study that explored women's vulnerability and needs with respect to climate change" (Lo & Dieng 2015), a reference to the report (Carr, Fleming, et al. 2015) and article (Carr, Fleming, et al. 2016) HURDL produced after this fieldwork.

Because this fieldwork was not intended to assess a functioning climate information service, we did not gather data on the use of CIS information in Ngetou Malick. Panal was not yet fully participating in the MWG program. However, in Panal we did identify the sources of data residents used to inform their livelihoods decisions, the place of formal weather and climate information delivered via radio from the MWG in those decisions, and the reason why this information has not been adopted widely. By connecting the uptake of climate information to the logic of livelihoods described above, we can explain these patterns in Panal, make reasonable predictions about the uptake of this information across Zone SN10, and identify both users and needs that are not being met by this information.

### **9.1. What is being delivered?**

According to Lo and Dieng (2015), the MWG delivers seasonal, 10-day, and daily forecasts (issued twice daily), as well as warnings of extreme events made a few hours before an event. The seasonal forecast is presented as one of three outcomes: rainy, normal or deficit. This forecast is intended to help farmers select appropriate varieties for the season, and to warn relevant government

organizations if a deficit season is predicted. Once the rainy season has started, ANACIM produces 10-day forecasts aimed at the identification of dry spells (a common feature during the onset of the rainy season) and other relevant trends in the likely patterns of rainfall in the immediate future. These forecasts are intended to inform activities like the application of fertilizer and planning for pest infestations. The daily forecasts predict intensity of rain and the time of day it will arrive, which are important for the timing of activities such as the storage of fodder or crop drying before transportation to market. Finally, warnings of extreme events are targeted at wind and thunderstorm events whose outcomes can put people and animals at risk.

## **9.2. What information do farmers use to inform livelihoods decisions?**

In the course of fieldwork in Panal, the field team asked residents about their livelihoods decisions, and sought to identify the sources of information they employed to inform these decisions. Figure 9.1 illustrates the relative use of these different sources of information. The use of local indicators, all rooted in the environment, dominates the decision-making of residents of Panal. While this aligns closely with findings from other parts of Sudanean and Sahelian West Africa (e.g. Carr, Onzere, et al. 2015; Carr, Onzere, et al. 2016; Onzere et al. 2017; Roncoli et al. 2002; West et al. 2008; Roncoli et al. 2001), it is a significant departure from the findings of the CCAFS baseline survey (Yacine et al. 2011), which appears to suggest not only that just 0.9% of households in the region employ local indicators or knowledge to predict the start of the season but further, that the use of local knowledge is a new and growing trend. Given this region has been farmed long before there was formal climate information, and farming decisions were surely informed by experience and local knowledge of the environment, it seems unlikely that this percentage is accurate, or that it could represent a growth in the use of this information. The use of formal forecasts is only reported by 16.5% of those in Panal. The relatively low rate of forecast use is not surprising, as Panal has not, thus far, been formally incorporated into the MWG program. That program provides training and face-to-face interactions during the rainy season intended to support farmers as they learn to use this information. None of this has been done in Panal yet, making this study something of a baseline assessment of climate information use in this area.



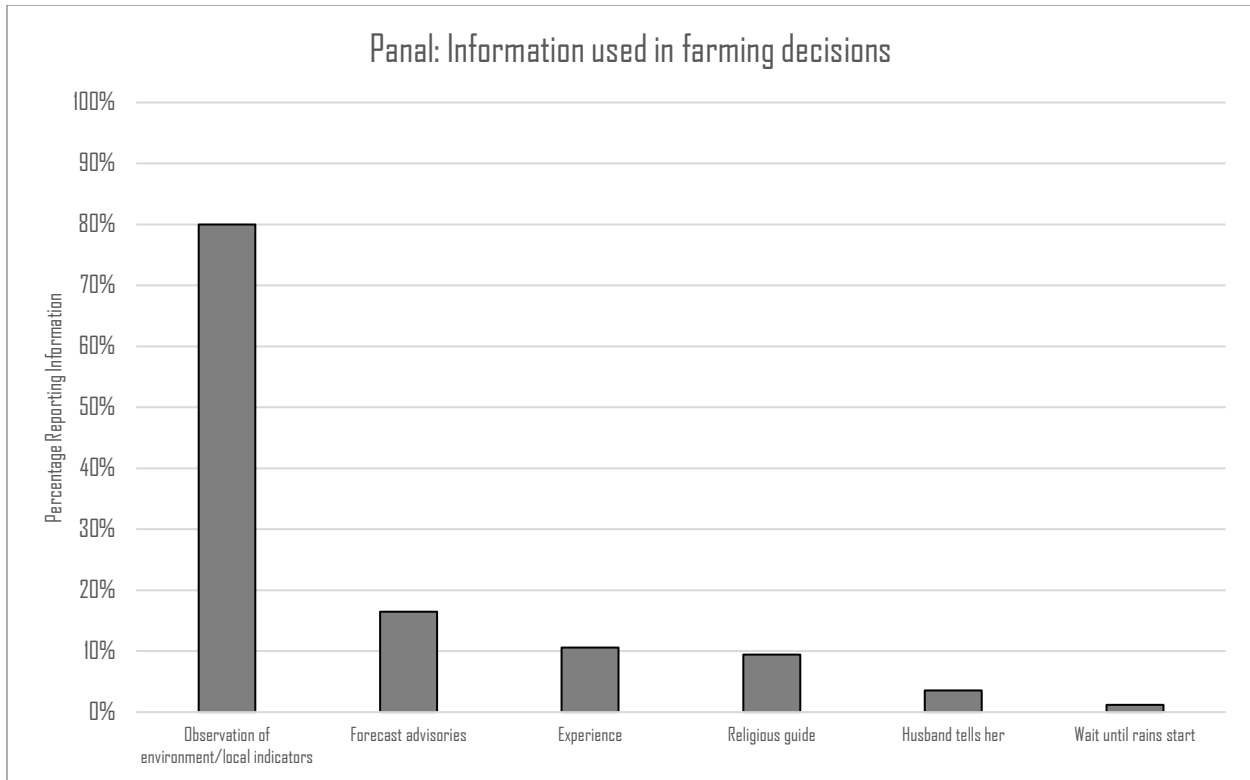


Figure 9.1: Sources of information used by residents of Panal to inform their agricultural and wider livelihoods decisions.

If we look across vulnerability groups in Panal, an interesting pattern emerges. As households become less secure, they report similarly growing rates of engagement with local knowledge and environmental indicators, and with religious figures to obtain guidance for their farms. This pattern suggests households in stress, with few options except traditional knowledge to inform their agricultural decisions. The vast majority of those with LRL, when asked directly about forecasts and climate information, reported not hearing the information directly, but instead finding out about their predictions via “rumors” in the community (Interviews PN42, PN38, PN46). One senior woman (Interview PG73) explained this explicitly, saying she did not have the ability to follow agricultural advisories because she did not have farming equipment, but “If I had farming equipment I could have the ability to intervene when the advisory is given.” At the same time, the most secure members of the community report lower rates of engagement with all forms of information than any other group, including forecasts. In this group, whose livelihoods strategies consistently yield a secure subsistence and often produce surpluses, there is much greater confidence in the local indicators they have been using. For example, one senior man (Interview PT71) said that if it started raining, but the meteorological service said it was not yet time to plant, he would go to plant if other farmers in the village were planting and if his observations of local indicators suggested it was the start of the rainy season. For this group, the probabilistic character of forecasts and their uncertain spatial resolution make them less attractive than existing sources of local information. A senior man said he listened to forecasts on the radio, which announces the arrival of rains, “but often it does not happen as advertised” (Interview PS55). This man says he has never used forecasts in his decisions, instead using traditional knowledge and indicators such as reading the stars and observing clouds.

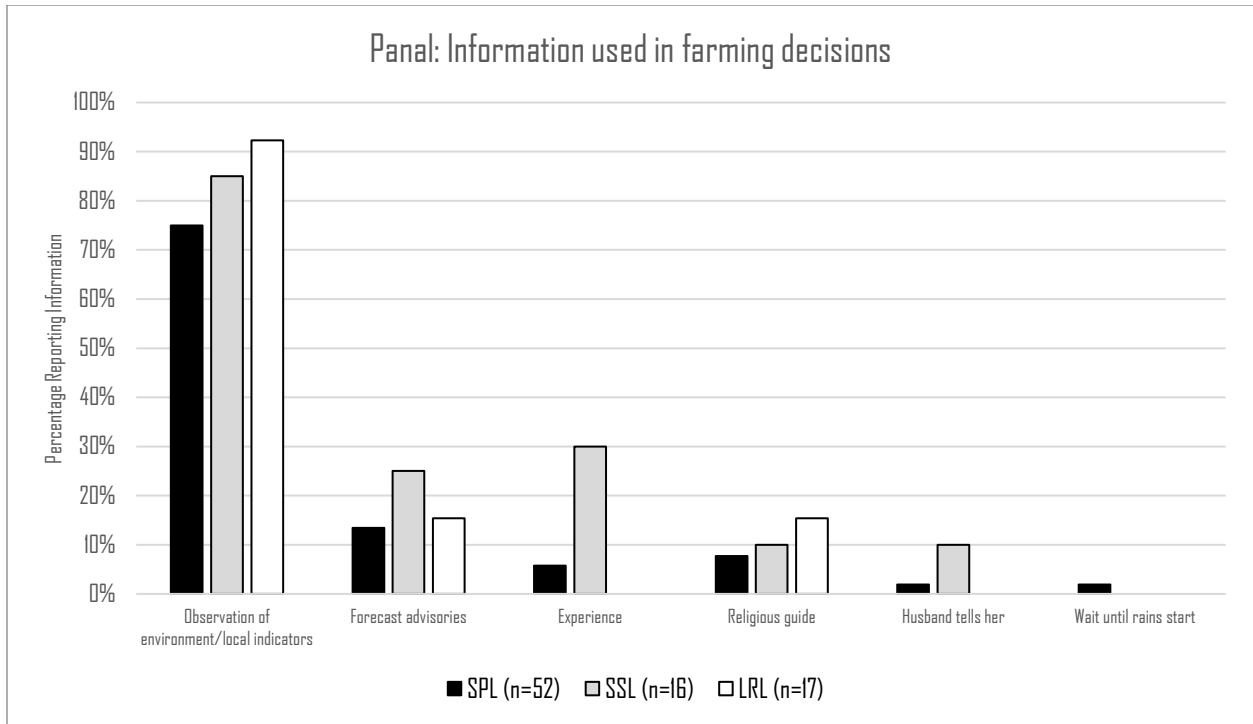


Figure 9.2: Sources of information used to inform livelihoods decisions in Panal, by vulnerability group.

Finally, if we look at source of information by gender, the patterns are similar. Women overall report higher rates of use of most forms of information, but in many cases these rates are marginally higher than those of men, and in the case of forecasts, are nearly identical. This pattern is interesting because the vast majority of women cannot make agricultural decisions until very late in the season, when they have finished working on their husbands' farms and can gain access to plows and draught animals. At that point of the season, there are often few decisions to be made with regard to variety selection or fertilizer application.

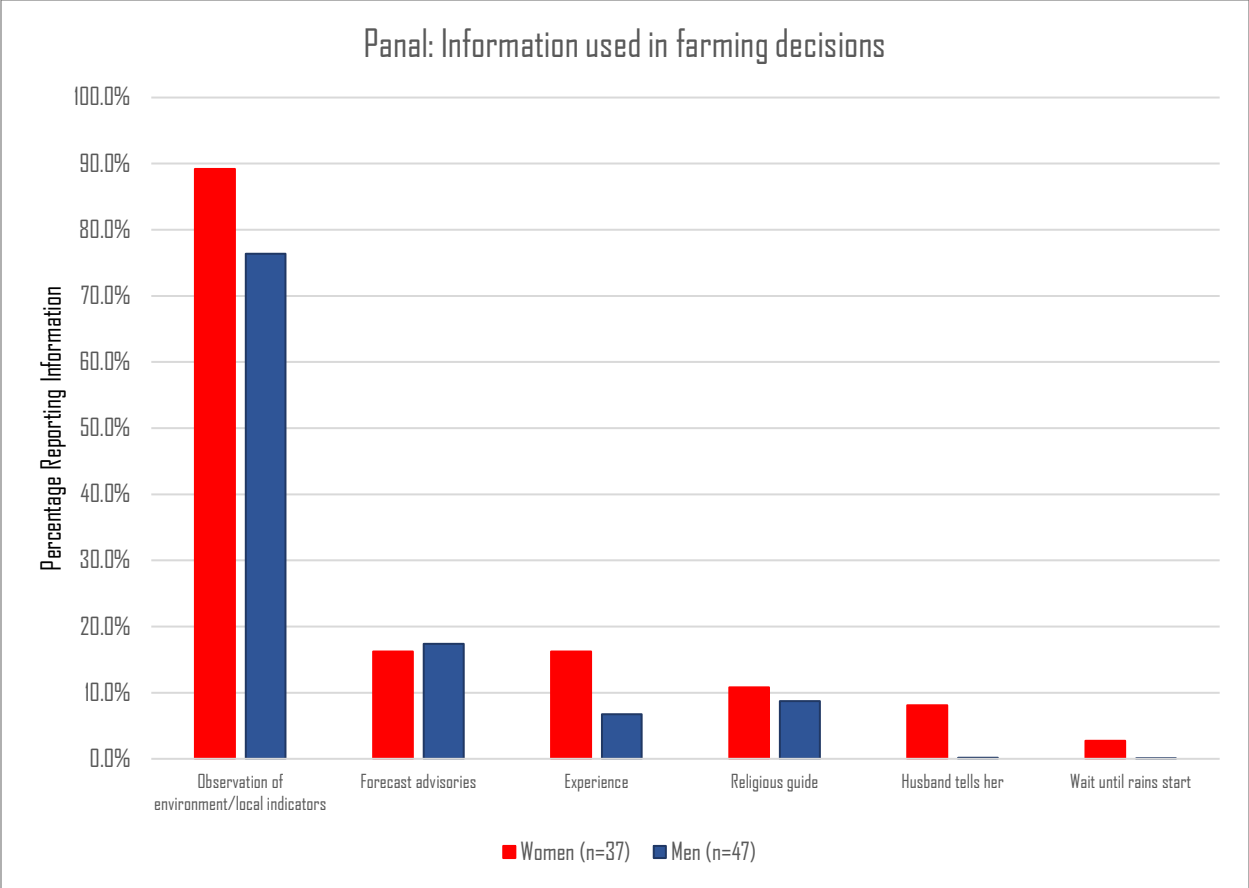


Figure 9.3: Sources of information used to inform livelihoods decisions in Panal, by gender.

**9.3. How much do farmers know about the MWG advice?**

The very low reported rates of forecast use in Panal reflect a great deal of confusion around the information the forecasts provide. Figure 9.4 illustrates two things. First, it lays out the information farmers reported receiving from the forecasts. Interesting in this list is that none of the responses is wholly incorrect or inappropriate, but that the responses conflate the forecasts and the advisories that the local MWG would build from those forecasts. Thus, the farmers are correct that the forecasts speak of rainfall, temperature, and wind from seasonal to daily timescales. While every other type of information below is different than the forecasts, they are all built on ANACIM forecasts via the MWG process. More importantly, while many residents report receiving rainfall and wind data, most of the farmers in Panal do not receive actionable information from the forecasts, such as which crops and varieties to plant given the likely characteristics of the upcoming season.

Figure 9.4  
 Figure 9.4: The types of information residents of Panal reported receiving via the CIS (left), the number of types of information the average resident identified, and the percentages of residents who could identify any type of information (right).

On the right side of Figure 9.4 is data on the breadth of the information residents received from the forecasts, and the percentage of the population able to identify any information received via the forecasts. Overall, fewer residents of Panal report receiving weather and climate information than in

the broader regional baseline published by CCAFS in 2011 (Yacine et al. 2011). In that baseline, for example, 53.7% of the sample reported receiving information on the start of the rains, while in Panal only slightly more than 35% reported receiving this information, or indeed any information about rainfall. However, in Panal women identified forecast information at a much higher rate than seen in the CCAFS baseline, and at a slightly greater rate than the men in this community. This is surprising in that men make nearly all decisions about rainfed agriculture for their own and any family fields, fields which are prepared and planted first. In short, men are more likely to be able to act on forecasts in their agricultural planning, but appear less engaged than women who have little such authority, and often start their own farming activities long after the rains have started, and late enough that they have to plant short-cycle crops, rendering seasonal advisories useless. It is also interesting that nearly 77% of LRL residents were aware of at least one kind of information that might be delivered by the forecasts, while only 60% of SSL and a remarkably small 36.5% of SPL residents could do the same. As with women, this pattern is counterintuitive, as much of the forecast information, such as seasonal precipitation, are not particularly useful to this group as they are often the last to prepare fields and often farm short seasons that require the use of short-cycle varieties. Meanwhile, those most able to act on these forecasts, those with SPL, appear to pay little attention to them. As noted above, it appears that those with SPL, with the experience of their current livelihoods successes, find little need to obtain new information that might inform their decisions. For those with LRL, however, local information has not yet been sufficient to change their situations, making the potential incorporation of new weather and climate information more attractive.

#### **9.4. What reasons do residents give for not using the information?**

Figure 9.5 represents data from the residents of Panal who reported not using forecast information. This chart represents the reasons they gave for not using forecasts in their decision-making. The most frequently-cited reasons were a lack of knowledge of how to use the forecasts, and a lack of trust in their accuracy. In this sense, the MWG model seems well-designed, as it uses face-to-face interaction and farmer training as part of its efforts to increase the uptake of weather and climate information by farmers. Such trainings allow farmers to learn how to use the forecasts, while the face-to-face interaction with those producing the forecasts and advisories, as well as opportunities to meet other farmers using this information, is likely to address issues of trust and confidence. As Panal has not yet been brought into the full suite of MWG activities and services, it is likely that engagement with MWG will reduce the number of farmers who mistrust the information.

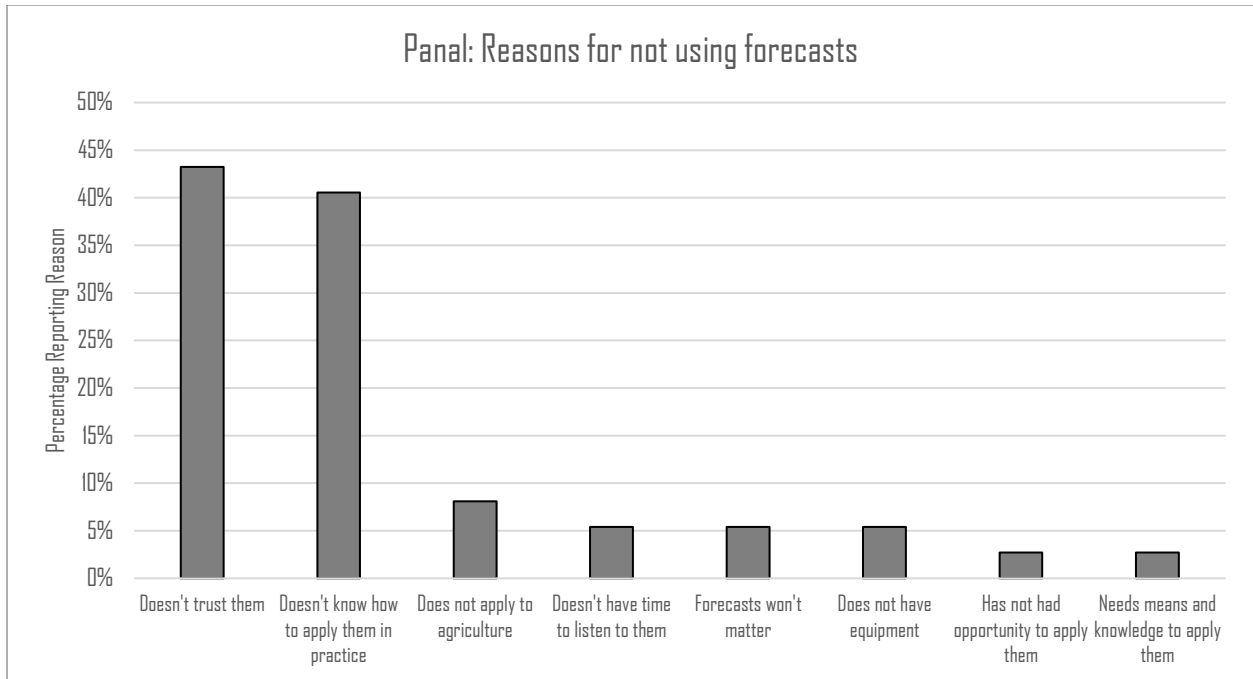


Figure 9.5: For residents of Panal who reported not using forecasts, the reasons they did not.

When we disaggregate the reasons for not using the forecasts by vulnerability group, we see that these issues are not evenly distributed throughout the zone. Those with SPL do not trust the information, and do not feel that it applies to their agricultural practices. As this is the most successful group, and many achieved their success before this project started, they have useful sources of information that inform their decisions already, and have not yet seen evidence that the climate information provided in this project is of greater use or reliability than what they already have. For those with SSL, the concerns are more focused on how to use the advisories, though there is a significant number of people in this group who are worried about forecast accuracy. Those with LRL are principally concerned with their lack of knowledge regarding how to use the advisories. This suggests an interest in the information and how it might help them improve their livelihoods outcomes.

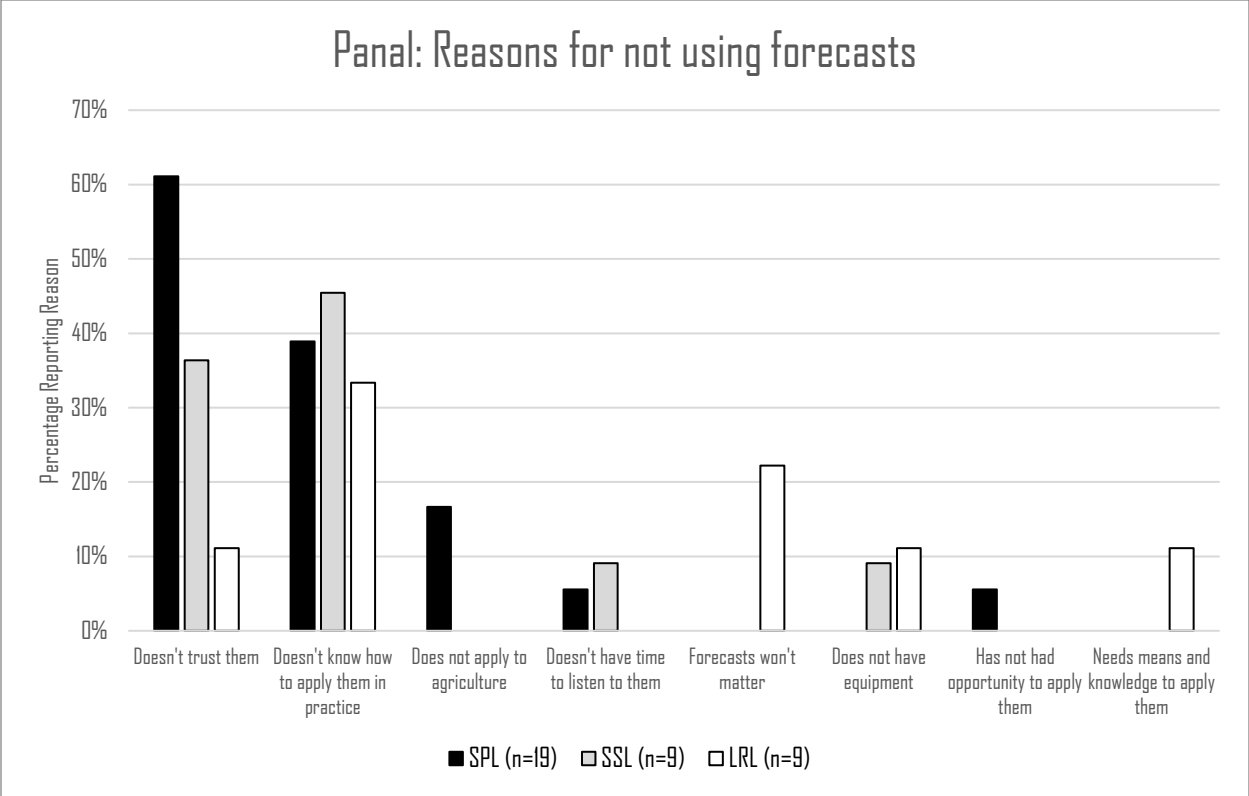


Figure 9.6: Reported reasons why residents of Panal do not use the forecasts, by vulnerability group

There are also clearly gendered patterns in the reasons why residents of Panal do not use this information. Men are much more concerned with the accuracy of the forecasts, and the applicability of forecasts to their agricultural practices. Women are more concerned with a lack of knowledge regarding how to use them.

The percentage of women reporting not knowing how to use the information was very consistent across all three groups. However, an effort to train women across all vulnerability groups is likely to generate uneven results. Among those with SPL, the relative security of those in this group suggests that women's use of this information, and any material success they might generate from such use, will not create social stresses within their households. At the other end of the vulnerability spectrum, we see hints (for example, in women's reduced rate of engagement with millet cultivation) that women's activities, roles, and responsibilities are policed somewhat more carefully among those with LRL. Therefore, interventions aimed at improving women's access to and use of climate information needs to be treated with caution to avoid potential backlash of gender-based violence in response to perceived challenges to existing gendered power dynamics. As seen in other settings, the LRL focus on meeting material needs via highly precarious agricultural production and limited assets produces a greater emphasis on members of the household and community playing their roles and meeting their responsibilities. Those who move outside such roles and responsibilities not only threaten the social order, but can be constructed as threatening the material well-being of the household and community. While this does not preclude interventions aimed at increasing and improving women's use of CIS in households with LRL, those implementing such interventions should acknowledge the potential for negative ramifications, be sensitive to cultural contexts, and design interventions appropriately with 'do no harm' principles. In the short term, unless the introduction of climate

information into LRL women’s livelihoods activities and decisions serves to help them live up to these roles and responsibilities, we are not likely to see them take up this information, and we might see significant pressure from the men in this group on women to make them revert to expectations.

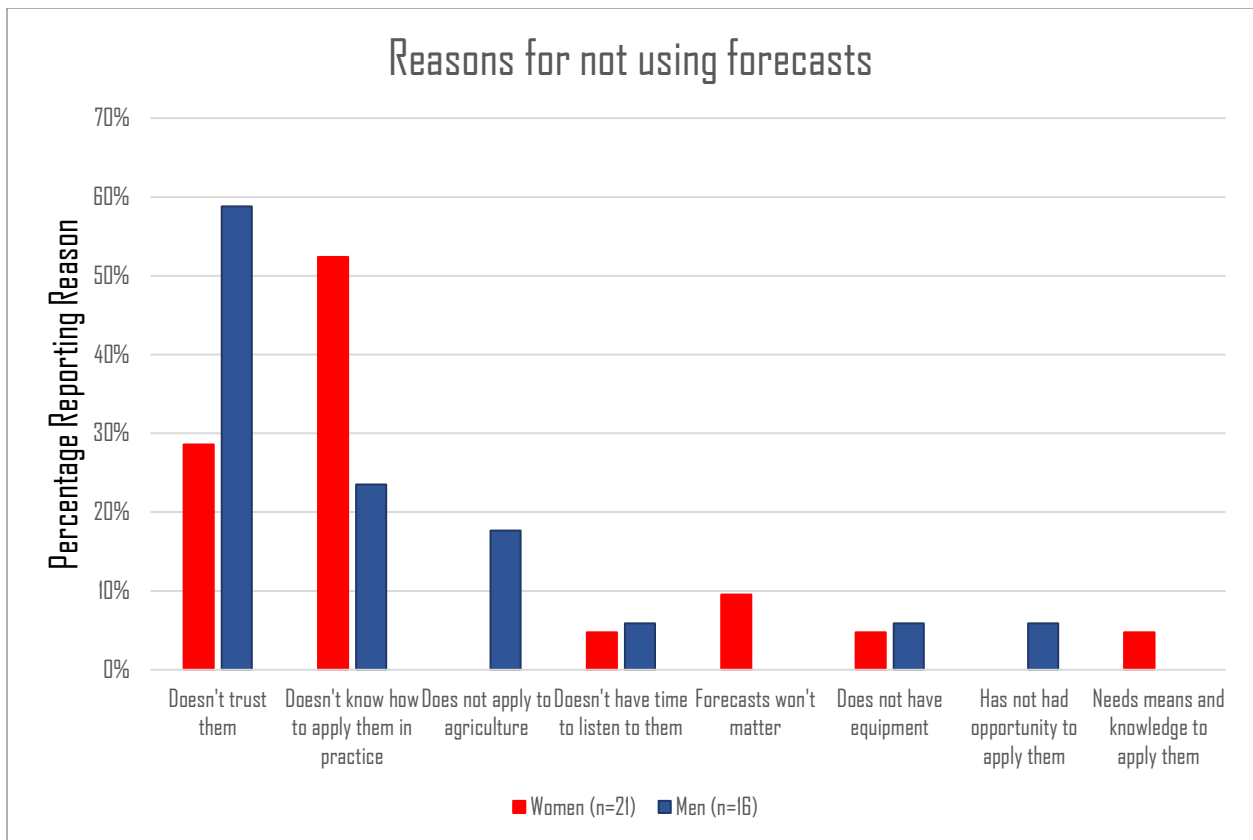


Figure 9.7: Reported reasons why residents of Panal do not use the forecasts, by gender

## 10. FORMULATING EFFECTIVE DESIGN PROCESSES AND IMPACT EVALUATIONS FOR CIS

The goal of a LIG analysis is to capture the roles and responsibilities played by various members of a community and to explain why members of the community seek to fulfill their roles and responsibilities in particular ways. The LIG analysis presented here has sought also to explain why particular members of the community experience certain vulnerabilities in the way that they do and how they are likely to respond to available opportunities to address those vulnerabilities or otherwise improve their situations via weather and climate information. This report has, hopefully, accomplished two goals. First, it has established a behavioral baseline for this zone, providing insights into how different community members are likely to experience, prioritize, perceive and make decisions in relation to the vulnerabilities associated with their livelihoods prior to the implementation of the MWG project. Second, in laying out the existing logic of livelihoods in this zone, it provides a baseline against which to measure future logics of livelihoods to understand how CIS interventions have an impact not only on material aspects of people’s livelihoods but also on the logic of those livelihoods. Finally, it identifies the pathways through which this information is most likely to impact individual goals, and therefore decisions and practices aimed at those goals.

Therefore, this project has provided the information necessary to design and implement a rigorous impact assessment of the MWG project as it is implemented across Senegal.

An effective impact evaluation of the MWG project will require certain characteristics.

### 10.1. Sample stratification

- In Zone SN10:
  - Stratify the population by assemblages of vulnerability. Given the consistency of this stratification across Panal and Ngetou Malick, two very different parts of this livelihoods zone, the stratification used in this study can be used in any CIS design and impact evaluation confined to Zone SN10.
  - Stratify the vulnerability groups by gender.
  - Within Zone SN10 a stratification of the population by vulnerability group and gender captures most of the difference in roles, responsibilities, and decision-making opportunities that shape observed livelihoods outcomes.
- In other livelihoods zones:
  - Identify a limited but meaningful set of vulnerability groups within the population. If livelihoods activities, or crops cultivated, are different than those seen in SN10, these groups are likely to be different as well.
  - Stratify the vulnerability groups by the social characteristics that shape the roles and responsibilities of individuals vis a vis activities that might be shaped by climate information.
  - Areas where livelihoods are organized around monogamous households are likely to require stratification by gender
  - Areas where livelihoods are organized into concessions or compounds of multiple households will likely need stratification by gender and seniority
  - In areas where multiple ethnicities live in shared communities, investigators should determine if different ethnicities have different roles and responsibilities to decide if this is a relevant social difference.

### 10.2. Identifying uptake and use

- In Zone SN10:
  - Uptake and use of climate information is a product of three key factors emerging from livelihoods in this zone:
    - *Whether one's roles and responsibilities provide the opportunity to make decisions about livelihoods that might be informed by this information.* For example, as we demonstrate above, women's roles and responsibilities effectively preclude them from focusing their livelihoods on the cultivation of rainfed grains, and they have little say in the decisions around such production on the fields of their households or their husbands. Therefore, information aimed at improving practices around the cultivation of rainfed grains is not likely to be taken up by women in this zone without significant, broader efforts to facilitate transformation in gender roles.
    - *Whether one has access to the assets needed to respond to the information. Responding to advice about what to plant and when requires timely access to appropriate seeds, traction, and equipment.* Following the example of rainfed grain cultivation above, if a farmer lacks access to appropriate seeds (either for a particular crop, or a particular variety of that crop), or lacks access to animal or mechanical traction, or lacks



access to a plow, he (or in rare cases, she) will not be able to use agricultural advice tied to either crop/variety selection or the timing of activities.

- *Whether one feels the need to change livelihoods practices to achieve goals, whether personal goals or goals shared by a household or community.* For example, among those with SPL in this zone, many sought to expand their production and incomes. However, many others did not report concerns for greater access to animal traction, seeds, or equipment. This latter group is not concerned with expanding production and incomes, and at the same time does not appear to be concerned about losing that security in the case of a shock or stressor. It is therefore not surprising that those with SPL report the lowest rates of engagement with formal climate information. They are already secure, and many members of this group are not interested in increasing production, and therefore existing sources of information remain adequate for their needs.
- In other livelihoods zones:
  - Gather uptake and use data via sampling that accounts for the stratifications identified through the steps above
  - Community-level data on uptake and use obscures critical differences in the levels of uptake/use across vulnerability groups, and within vulnerability groups. This makes explaining overall rates of use impossible, as the overall rates of use are just aggregations of many different rates up uptake and use determined by roles and responsibilities, and access to the assets needed to live up to the expectations associated with particular roles and responsibilities
  - Failure to properly stratify the populations of each livelihoods zone is likely to overlook segments of the population that are using the information, as well as those who are not/cannot use the information.

### 10.3. Identifying impacts of use in Zone SN10

While it is possible to lay out principles of sample stratification that inform work in any livelihoods zone in Senegal, identifying a general set of measures and indicators of impact is much more difficult. Appropriate measures will be specific to livelihoods zone, vulnerability group, and identity, as climate information will impact people across these axes differently. As described above, HURDL employed the LIG approach to establish the different patterns of decision-making in Zone SN10. Those patterns enable the identification of the following measures and indicators of impact, and the expected direction of change for each, in this zone.

- Across all groups
  - It is critical to identify whether yield increase or avoided loss best characterizes the outcomes of information use, as this will define how to interpret crop and variety selection. Crop and variety selections should shift to achieve one or both of these goals, and ideally should be tied to climate information provided by this program.
  - Rigorously assessing the outcomes of information use via crop and variety selection requires more information that can only be gathered across successive agricultural seasons with different conditions:
    - Groups may use the same information to different ends depending on seasonal conditions (boosting yields in a good year, while avoiding losses in a challenging year)
    - Different sources of information might be more useful for avoiding loss than boosting yields, and vice versa.

- Appropriately calibrating “control” levels of production against which to measure avoided loss or increased yields will also require data from multiple agricultural seasons under different conditions.
- Among those with SPL
  - As farmers did not report significant issues with local markets, yield increase is an appropriate measure, as it is a goal of those in this group. Peanuts will be the focus of initial effort, though eventually crops like sorghum, millet, and cowpeas will likely also benefit from accurate and timely information. Cowpea increases will likely be most visible among women, while sorghum yields will change most clearly under men. This measure, however, will become less reliable if markets become problematic.
  - Variety selection is another appropriate measure of impact. Members of this group, especially men, have the ability to respond quickly to advice, and to access the varieties recommended, and therefore an effective CIS should drive greater adoption of appropriate varieties of rainfed crops. Women may not show the same responsiveness if their production is significantly delayed, as they will be forced into short-cycle varieties by the length of the season, regardless of seasonal or other forecasts.
  - In the northern and western parts of the zone, increased diversification of draught animal ownership, and increased numbers of draught animals, should be tracked as this is the one area of fragility in the livelihoods of this group. This will be most relevant for men. For women, increased ownership of poultry, and any new ownership of goats or sheep, would suggest a trend toward asset accumulation.
  - Credit should be tracked for this group. It is not clear how effective CIS might impact the use of credit, as it is possible effective climate information might enable larger loans by reducing the risk of failure and debt. On the other hand, it might reduce the need for loans as yields and incomes increase.
  - Women’s incomes should be tracked. If these households become more secure and successful, men will feel less pressure to live up to their role as providers for the family. There is evidence already that women living in more secure households are able to take on a wider range of activities, and plant a wider range of crops, than women in stressed households. This is not merely a function of access to assets, but also a function of men allowing such activity because it does not pose a threat to their authority.
- Among those with SSL
  - Yield increase should be measured, as it speaks to the goals of this group. However, those with SSL are more defensive in their orientation than those with SPL, particularly in the northern and eastern parts of this zone.
  - In areas where no yield increases are visible for peanuts, millet, cowpeas, sorghum, or maize, efforts should be made to assess any loss avoided through the use of the climate information. This is particularly true in the northern and eastern parts of the zone, where farmers may be more concerned with avoiding loss and a decline to LRL status than they are with increasing production and achieving SPL status. This will require multi-year measures of yield and local agroecological conditions.
  - Among men, the diversification of draught animal ownership, and increases in such ownership across the zone, are likely outcomes of successful efforts to either increase yields or avoid losses. In either case, the information will result in greater financial resources at the household level, either through increased earnings or loans and asset sales avoided. Further, the diversification of draught animal ownership serves both those who seek to increase yields and those who are trying to avoid losses. Increasing women’s

ownership of poultry will also indicate that the information is resulting in greater resources in the household. If women begin to accumulate sheep and goats, it would mark a significant improvement in their financial situation.

- Among men, the purchase of one or more plows through profits from their farms would be an indicator of a significant, and even transformative, impact of this information, as this would signal an overall shift to SPL status.
- Useful information will, for members of this group, reduce their need for credit. If the information has an impact, it will likely be visible in decreasing loan size (minor impact) and even decreasing frequency of borrowing money (significant impact).
- While tracking women's income is important, it is not likely that climate information would produce significant changes in SSL women's income status in the short term. First, their agricultural production is significantly delayed by the fact that they do not own agricultural equipment or animal traction, and their husbands do not either. Therefore, they must wait even longer than women in SPL households to plant, and likely have to contend with a short season regardless of forecast. Second, men in this group are not as secure as those with SPL, and are likely to feel more threatened by rising women's incomes than men with SPL. This is particularly true in the northern and western parts of this zone, where agricultural production and incomes are more precarious and likely more defensive.
- Among those with LRL
  - The most likely impact of this information on yield will be seen in avoided loss. These households are so asset poor that the significant delays in their planting heavily constrain yields, and even the most accurate information cannot address this barrier to production. By providing accurate information on the remaining length and quality of season, however, this CIS could marginally inform late season planting decisions, enabling greater yields in years where the season is longer and wetter.
  - For farmers in this group, variety selection will only be informed in the longest and wettest of seasons. In regular and unfavorable seasons, the wait for equipment and traction will constrain selection to very short-cycle varieties.
  - Any increases in animal ownership via purchase through agricultural profits would indicate a positive impact. However, these households and individuals will remain extremely sensitive to shocks, and therefore even useful information that contributes to greater yields and incomes could be overlooked if households have to sell animal assets to address shocks.
  - To better assess the changing precarity of those with LRL, measuring access to and use of credit alongside animal ownership will provide a more rounded picture of impact. If those with LRL are able to purchase more animals only to sell them to address shocks, the sale of these animals might reduce the need for credit, as measured in the size and number of loans taken. In this way, those with LRL might not accumulate assets quickly, but they may more easily avoid recurring debt and the degradation of their assets.
  - As those with LRL become more secure, the constraints on women's activities enforced due to significant stress will start to relax. In agricultural practice, this will likely be evident in increasing rates of millet cultivation and possibly increasing rates of sorghum cultivation. Because of the complex pressures on women with LRL in this zone, it is difficult to clearly establish an expectation of changes in measured animal ownership if the climate information is useful. It could be that women will increase the amount of

poultry they own, but if they are continually addressing shocks by selling that poultry, the better measurement might be in the use of credit as described above.

Identifying the impacts of use in other zones will require a similar behavioral baseline exercise to establish current conditions and decision-making against which to track the impacts of climate information use. However, once these baselines are established, they can be used to provide rigorous, nuanced interpretations of other datasets, such as panel surveys, that are already implemented and frequently updated. A subsequent CISRI report exploring the integration of ethnographic and large-scale survey data takes this up in more concrete detail.

## 11. ADVANCING THE DESIGN, MONITORING, AND EVALUATION OF CIS

This report speaks to two CISRI learning agendas intended to identify and address knowledge gaps in the field of climate information services. The first of these speaks to the identification of CIS users and their needs (Carr et al. 2017). That learning agenda laid out a series of questions that required more evidence or research to answer constructively. This study speaks to several. First, the agenda asks *“Over what spatial region or social groupings can a particular CIS be scaled? What factors affect that?”* (Carr et al. 2017: 29). This study suggests that the broad structure of livelihoods decision making is coherent at the scale of the livelihoods zone, even one where conditions vary significantly. This suggests that climate information can be tailored to the decisions those in this zone make, and the basis on which they make them, and reasonably expect that this information will serve the Wolof agriculturalist population of the entire zone<sup>5</sup>.

This said, not all information will serve all residents of a given livelihoods zone. This study also provides more information in response to the question *“What are the broad lessons we might learn about the social constraints to the use of climate information?”* (Carr et al. 2017:29). The LIG analysis above identifies a range of social constraints to the use of climate information. For example, in SN10 women are not seen as appropriate cultivators for crops like millet and sorghum, and therefore do not cultivate as many crops that might benefit from such information as seasonal onset as men. Further, in this zone the practice of privileging men’s agricultural production over that of women delays decision-making for women until they are allowed access to plows and draught animals, a delay that at time forces women to select certain crops and varieties simply because there is not enough time left in the season to facilitate a range of choices. These specific findings point to a wider process by which those seeking to better understand the sources and impacts of social constraints on the use of climate information might use:

- 1) Stratify the community into vulnerability groups to identify who is vulnerable to which shocks and stressors.
- 2) Identify the principle aspects of identity that shape roles and responsibilities in the area in question.
- 3) Identify the consequences for those who do not conform to expectations.

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<sup>5</sup> As noted above, this study focused on Wolof agriculturalists because they are the target population for the CIS in question. To develop an understanding of the broader set of livelihoods in this zone, particularly pastoral livelihoods, will require at least extending this investigation to Pulaar-speaking pastoral populations.

The evidence at hand suggests that, at least in Zone SN10, if information works for particular members of a vulnerability group in one part of the zone, it will work in a similar manner for all of those who are in the same group, and have the same roles and responsibilities, across the zone. This study therefore suggests that even tailored CIS can be scaled to at least the livelihoods zone level. The information that emerges through each of these steps will vary by livelihoods zone, but will help to identify livelihoods-zone specific social constraints to the use of climate information.

Third, the agenda asks “*What are the differences in information gleaned through different methods, and how might different approaches be integrated to draw on strengths and eliminate gaps?*” and “*What are the most effective means of learning about users and needs in a given place?*” (Carr et al. 2017: 29). While this study is purely qualitative, and largely ethnographic in its approach, it serves to highlight the sorts of information that such work can provide to our understanding of CIS users and needs. While surveys are useful tools for gathering large numbers of observations about outcomes, when applied to the social realm they are less useful for interrogating the causes of those outcomes. Ethnographic information focused on livelihoods decision-making explains these patterns, and comes with a high degree of internal validity, as data from one source (for example, an interview) can be triangulated with data from many other interviews, observations of daily life gathered by field teams, data on markets and prices for crops and animals, and weather and climate data for the place in question. While we argue that the evidence from Zone SN10 suggests that LIG-informed findings have external validity at the scale of the livelihoods zone, this claim only holds for the structure of decision-making. This study does not claim to have a representative understanding of the material outcomes of those decisions across the entire zone, and therefore the external validity of its findings with regard to material outcomes is limited. A subsequent CISRI report will explore the integration of this ethnographic data with systematic survey data collection to link livelihoods decision-making to externally-valid observations of material outcomes, allowing for the rapid and relatively cheap design and evaluation of a variety of programs in which a LIG analysis has been undertaken.

This project also speaks to the CISRI learning agenda on monitoring and evaluating climate services (Vaughan et al. 2017). For example, in elucidating the goals of different actors in a livelihoods zone, this study demonstrates how to *identify and potentially measure a broader range of impacts than yield alone* (Vaughan et al. 2017: 23). First, in Zone SN10 we demonstrate that yield outcomes can be of two types. One is an increase in yield, but this goal and outcome is best associated with the wealthiest and most secure individuals and households in the zone. The other is a maintenance of yield in the face of adversity, an outcome we would expect to see most clearly in resource challenged households whose principal focus is on obtaining subsistence each year. Second, we show that weather and climate information can shape the number and size of the loans taken by farmers to facilitate their production. Third, we point to ways in which we might see broader social changes, such as shifts in the status of women, as a product of weather and climate information. For example, if this information makes men more secure in the achievement of their responsibilities, we see evidence that women will be granted more space to expand their own incomes, farm new crops, and take up new activities. In such a situation, women may be able to make use of information that currently benefits men, and will also develop their own CIS needs. This study also helps deepen the ways in which we *interpret existing results* of CIS (Vaughan et al. 2017: 24). By more clearly defining who the users of the MWG project are, what their needs for weather and climate information are, and what sorts of impacts might be produced by the delivery of credible, salient information, this study demonstrates the sorts of information that are needed to design impactful CIS, and what information is needed to monitor and evaluate CIS as they seek to achieve these goals.

In summary, taking a detailed, qualitative approach to the livelihoods of prospective climate service users serves to better understand who these users are, what their needs are, and how CIS can fill some of these needs. Further, this approach clearly identifies the most likely pathways through which a CIS might address user needs. This information facilitates the design of impact assessments that measure relevant indicators of impact and whose interpretations are informed by empirical evidence. Taken together, this approach shows potential for designing effective CIS, and monitoring and evaluating such CIS to maximize learning, such that weather and climate information might live up to their potential as tools for development and adaptation.

Maybe we need to be more direct about the inadequacies of current CIS approaches and what they are likely to yield. I understand we want to be forward looking but I think we could usefully be more direct.

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