KEY RESULTS

DESCRIPTIVE ANALYSIS

- The average size of the households surveyed in Wau was 6.3 persons. Most households identify as Christian, predominantly Catholic, with a small percentage of Pentecostal, Anglican and Adventist. Of the 7 PAs Wau has the largest Islamic representation, at nearly 10%. Wau is also one of the most ethnically heterogenous PAs. Dinka and Balanda are well represented, but also Zande, Jur/Luo, Otuho and roughly 25% “other.”

- Compared to FBOs and central government, Peace Committees play the most important leadership role in Wau along with Police, NGOs, and paramount chiefs.

- The qualitative survey revealed a mixed view of government services. Some criticized the government for corruption, poor management of South Sudan’s wealth of natural resources, poor security on many roads, and delayed payment of government workers. Yet others expressed the sense that the government was doing the best it could to maintain basic services and provide security services. The predominant requests of government—especially by focus groups of youth—were to provide more education, especially at low cost (or free).

- Focus groups and interview responses revealed that there may be tension in communities around the role of traditional leaders, and whether the facilitation of services (by government or organizations) should be channeled through chiefs and traditional leaders or directly to communities.

- Only a small proportion (13%) of households in Wau are familiar with the humanitarian, development and service agencies in their region, yet over 20% of households stated that NGOs or other agencies affect their household; the discrepancy difference may indicate data error or poor job by the agencies to properly introduce themselves.

- Compared to other PAs, the prevalence of households affected by social risks is relatively moderate in Wau. Outside the home, households reported burglaries/robberies and gang activity as the most common risks. Within households, the strongly associated risks of alcohol abuse, domestic violence, child abuse and teen pregnancy are common, with particularly deleterious effects on women and children. More than 30% of households indicated rape was a prevalent social risk.

- Focus groups discussions confirmed the threats from gender-based violence, resource-based conflicts, tribalism and fire arms availability. They highlighted the constant threat of insecurity and effect of trauma. Insecurity traveling the roads, or when going out to cultivate crops was a common theme; fear and the threat of violence or theft paralyzes economic activity.

- Like many PAs, Wau faces land conflicts, especially between farmers and pastoralists. The government had attempted to address this issue: “There was a conference of farmers and cattle keepers in Maria Bai to resolve a conflict” though these efforts are not always successful, especially due to prolific firearms among cattle owners.
• Compared to other 7 PAs, Wau has moderate-to-high rates of literacy and household members that have been to school. Like other PAs, the difference between male and female literacy and education rates is significant. Conflict has serious implications on education. Qualitative data highlight complaints of how the conflict has closed schools, raised costs and robbed remote communities of quality teachers, and parents of incomes to pay school fees. Children left orphans after the conflict often can no longer afford school fees.

• Relative to other PAs, households in Wau have experienced the highest quality health care services. Eighty to ninety percent of households are served by a qualified healthcare professional, received enough information during health visits, and are served on time.

• Qualitative data showed the strong role that NGOs play in providing health education and access, including for HIV, hepatitis B and other diseases: “They have worked to encourage people and give many teachings so that people don’t have to hide when a disaster has befallen them like rape cases, HIV, or any other diseases.”

• While multiple water sources may be available in each community, most households depend on one or two primary sources. Hand pumps and vendor wells or open water provide the predominant water sources in Wau. Most households travel less than 15 minutes to the available water source.

• The seven PAs generally have a poor view of government services (Figure 1.28), and Wau is no exception. Wau’s population in particular complained about poor job creation, poor transportation infrastructure and lack of equity and poverty.

• Most households in the seven PAs experience lack of food over a 12-month period. Comparatively, Wau’s food insecurity rate of 36% was the least severe among all 7 PAs. Civil war and conflict are the main drivers of food insecurity in Wau.

• Though sorghum and maize are the primary crops, households in Wau prioritize a higher diversity of crops than any other PA, likely due to their higher urban market access. Within households as well, there is greater diversity compared to most PAs; many households cultivate cassava, onions, simsim, groundnuts, maize, millet or sorghum in addition to their primary crop.

• Focus group discussions reveal mixed desires for community self-sufficiency based on agriculture and the continual help from NGOs and outside organizations. Many comments praised the agricultural help from NGO trainings and resources: “The training from the NGOs has been fruitful and meaningful and we have learnt a lot and enhanced our agricultural knowledge on modern agricultural methods.”

• Agricultural groups are active, “We have around 20 agricultural groups in Agok, formed by Oxfarm organization,” and tied to (mostly) positive agency interactions “We have Oxfarm organization, which has helped us a lot. We also have what we call WATAP although their seeds are not good.” More than other PAs, Wau comments called for more modern machinery “tractors,” yet also stated that previously distributed machinery sat “broken and spoilt.”
Livelihood activities among Wau’s working population is highly differentiated by gender. Unlike the other PAs, merely half of adult males and females engage in crop production (fewer male youth, and data for female youth is missing). Females dominate the baking, retail, catering and food processing sectors, while males dominate construction, motor vehicle mechanic work and carpentry industries.

Like the quantitative survey data, qualitative data revealed the paralysis of insecurity for economic activity, inhibiting trade, preventing producer from working in more remote cropland and creating an ambiance of fear. Like other PAs, focus groups indicated concern for inflation and prohibitively high food prices.

**RESILIENCE MEASUREMENT**

- For the Access to Basic Services pillar, variables reflecting access vocational training and extension services play the most prominent roles in the pillar.

- The predicted numbers of flat irons and mosquito nets make the largest contributions to the Assets pillar, followed by predicted landholdings.

- The variables that contribute the most to the Adaptive Capacity pillar are those related to agricultural livelihood strategies: the number of agricultural livelihood activities and the number of crops planted.

- Access to remittances from South Sudan carried the most weight in the Social Safety Nets pillar, followed by knowledge of organizations doing humanitarian or development work in the community.

- As expected, the estimated resilience score has a positive effect on food security, as measured by the predicted numbers of household meals consumed and by the predicted Food Consumption Score (FCS). The largest impacts are on the number of meals consumed by the youngest age group (children 2–5 years old).

- Of the four pillars, only Access to Basic Services and Adaptive Capacity have significant effects on the resilience score.

- The effects of the pillars on resilience are not linear, suggesting the existence of threshold values that must be reached before increases in the pillar values begin to affect resilience positively.

- Female-headed households have worse outcomes than male-headed households for most of the food security indicators, especially dietary diversity, with average FCS values for female-headed households less than half those of male-headed households.

- Female-headed households also have lower resilience scores than male-headed households, while households with heads aged 56 and older have lower resilience than households with the youngest heads. Households in Wau North have higher resilience than households in Wau South.

- For all pillars, average values among sample households are lower than the threshold values after which increases in pillar scores increase resilience.
• The Access to Basic Services pillar and Adaptive Capacity pillar are potential priority areas for policymakers. The Access to Basic Services pillar has a strong effect on increasing resilience and represents an area in which a large number of households may be relatively close to threshold levels. The Adaptive Capacity pillar has the strongest effect on resilience.
BACKGROUND AND INTRODUCTION

Following four decades of civil war, South Sudan’s independence in July 2011 was met with international goodwill focused on putting the country on a development trajectory that finally brings about food security, health, education, and economic growth and development. However, a resumption of civil war in 2013 hindered the country’s road to economic development. The protracted conflict has created a humanitarian crisis in the country that has left tens of thousands of people dead, displaced millions more, and worsened food insecurity in the country. Livelihoods have further been battered by the effects of climate change due to more frequent and prolonged droughts and floods as well as pest infestations. Food production has been destabilized by the war, droughts, and weak national institutions and policies, and as a result in early 2017, parts of South Sudan, particularly in the north, experienced a famine that affected about half of the population. More recently, the latest integrated food security phase classification shows that in January 2018, 48 percent of South Sudan’s population (5.3 million people) was estimated to be facing crisis and emergency acute food insecurity.

The effects of a long-drawn-out conflict and climate change in the face of a weak national policy system and institutions have severely affected the food security, nutrition, and well-being of South Sudan’s most vulnerable. Therefore, South Sudan requires a broad coalition of support to address not only the urgent humanitarian crisis but also to help restore production systems and help communities cope, recover, and build their resilience to shocks and crises. Restoring production systems and productivity is important because growth in the agricultural sector remains the most effective driver for poverty reduction and restoring livelihoods in many African countries.

Given the multiple players involved and the weak national policy and institutional apparatus in the country, the United States Agency for International Development (USAID) in South Sudan has put together a Partnership for Resilience and Recovery (the Partnership, hereafter) in South Sudan that places community institutions at the center of efforts to build the resilience of livelihoods and production systems in the country. The proposed partnership is aimed at producing business models (interventions) for integrated humanitarian and development services through community-based delivery mechanisms that emphasize the productive sector as the foundation for resilience and recovery in five target regions: Torit, Wunlit Corridor, Wau, Aweil, and Yambio. The partnership provides a framework for the colocation of investments across all sectors; coordination of activities across partners; and collaboration among partners and stakeholders in defining and delivering interventions that achieve social cohesion, resilience, and recovery for long term development.

This report is an input into efforts to design interventions and investments in Yambio. It shares detailed findings from household data collection which shed light on living conditions, livelihood strategies, and household resilience in the region. The report has two major sections, which discuss findings from the descriptive analysis and from econometric analysis of resilience, respectively. Section one is divided into subsections on demographics; trust in people and institutions, including leadership, institutions and conflict; access to basic services, including education, health services, water, and other government services; and productive capacities, including food insecurity, agricultural productivity and market access. In section two, we implement the FAO’s Resilience Index Measurement and Analysis-II (RIMA-II) methodology to explore the contribution of the factors discussed in section one to household resilience and food security. Section two discusses the calculation of the RIMA index and explores additional determinants of resilience. Both section one and section two end with a summary of key messages.
DESCRIPTIVE ANALYSIS

I.1. DEMOGRAPHICS

This analysis is based on the Community Household Resilience Surveys completed by Management System International (MSI), in 2018. Data was collected from the seven counties, known as Partnership Areas (PAs) in South Sudan: Yambio, Awiel West, Torit, Wau, Bor South, Yei and Rumbek East. Consultations with various stakeholders facilitated the selection of these seven communities, with the objective of profiling community resilience as it relates to conflicts, livelihoods, poverty, shocks, markets, and their distinct impacts on men, women, children and elders.

Household surveys were conducted over a period of two weeks, including travel, training and fieldwork activities. Each enumerator surveyed roughly 60 households. Enumeration Areas were selected by probability proportion according to household size. The sampling frame was based on the 2008 Population and Housing Census conducted in South Sudan, with some updated information (Lubaale, 2018). Though sample sizes (n) differ for individual questions, the number of households surveyed is enough to validate the survey results as an acceptable basis to guide policy design and implementation (Table I.1). We also use qualitative MSI data gathered from focus groups discussions with farmer groups, adult females, adult males, male youth, female youth, schoolteachers, female farmers, male farmers, community-based organizations (CBOs), government peace committees, faith-based organizations (FBOs), and key informant interviews with local leaders, chiefs, executive directors, teachers and peace committees. All qualitative data in quotes comes from MSI focus groups and interviews.

The average size of the households surveyed in Wau was 6.3 persons. Our results suggest that households in all PAs face displacement and migration of family members. The absence of parent(s) in the household can hinder resilience by increasing the dependency burden on other adult caregivers or teenage children; research indicates that lower dependency ratios facilitate higher the adaptive capacity (Vincent, 2007). The MSI survey indicates that in Aweil 30% of mothers and nearly 45% of fathers live outside the household. A negligible percentage of families reported a deceased parent(s) or that they do not know whether the parent living outside the household is alive or deceased (Figure 1.3).

Most households identify as Christian, predominantly Catholic, with a small percentage of Pentecostal, Anglican and Adventist. Of the 7 PAs Wau has the highest Islamic representation, at nearly 10% (Figure 1.2). As shown in Figure 1.1, Wau is also one of the most ethnically heterogenous PAs. Dinka and Balanda are well represented, but also Zande, Jur/Luo, Otaho and roughly 25% “other.”

Population distribution in Wau suggests that there are more women than men (Figure 1.4), but the difference exists especially among young adult women (age 20-29) and to a lesser degree those between age 10 and 19. Among older generations the distribution of men and women within households is more
balanced (or dominated by males among elderly), suggesting that the gender imbalance onset occurs as boys become adolescents or young men. Older men and young boys may be less likely to migrate or become involved in “bush” groups or conflict, or to have been killed in conflict. As one mother stated, “The community of Wau county lost many people during the conflict mostly its male youth.”

1.2. TRUST IN PEOPLE AND INSTITUTIONS

LEADERSHIP AND INSTITUTIONS

Our results suggest that, compared to FBOs and central government, Peace Committees play an important leadership role in Wau along with police, NGOs, and paramount chiefs (Figure 1.7).

Over 30% of households indicated that traditional leaders play a more important role than political leaders and roughly 10% believed they have equal importance. A slight proportion believed political leaders had more influence, but over half of surveyed households did not know which played the more important role (Figure 1.5). Wau’s traditional leaders are predominantly appointed; roughly 30% are elected (Figures 1.6). The uncertainty in Wau about relative importance of traditional vs. political leaders may partly relate to the basis of authority. Across the seven PAs traditional leaders seem to carry more importance in the counties that predominantly elect them (Figures 1.5 and 1.6).
The qualitative survey revealed a mixed view of government services. Some criticized the government for corruption, poor management of South Sudan’s wealth of natural resources, poor security on many roads, and delayed payment of government workers. Yet others expressed the sense that the government was doing the best it could to maintain basic services and provide security services. The predominant requests of government—especially by focus groups of youth—were to provide more education, especially at low cost (or free).

Commentaries about NGOs, FBOs and other civil society organizations were overwhelmingly positive, praising them for their provision of services, promoting peace, providing valuable education and training, and basic help in times of need. As one chief put it “In reality it’s mostly organizations helping people.” There seems to be genuine consensus that organizations seek the best interest of local South Sudanese. Only a few comments criticized outside organizations, for displacing local business: “there are many organizations like the world bank that came here to promote our businesses but instead they are destroying our business; they told us that they will be saving our money but it turned out differently,” and “some organizations come and take information and lie to another organization that they delivered services to us yet nothing was delivered.” Or, in cases of tribal favoritism, “when organizations come here to distribute cards for receiving food items, we see some NGO staff give the cards only to relatives which means they sometimes are tribalistic.”

Far more than in other PAs, many comments acclaimed the valuable role that organizations have played in their communities. Remarks referenced dozens of organizations, and their positive impacts. FBOs and churches were also praised for their positive role in providing services and fostering peace. “As you know we had a conflict 3 years back and people ran to churches. Truly I have seen those churches help people who ran to them.” However, there was still some concern at the over-reliance on NGOs, which was undermining self-sufficiency and the community’s autonomy through agriculture. Organizations may be able to improve communication in remote communities to enhance their impact. For example, male farmers complained that “there is no awareness and information on the organizations’ visits—their visits come as a surprise to the people. Since they didn’t inform people they are coming some people are still out in their farms.”

Focus groups and interview responses revealed that there may be tension in communities around the role of traditional leaders, and whether the facilitation of services (by government or organizations) should be channeled through chiefs and traditional leaders or directly to communities. “The Chief is the nearest person to the community. You are not supposed to jump direct to the Government or Organizations.”
This filter, the “chief who knows both types of laws,” may not be welcome among all. For example, one focus group identified civil servants as “our only voice for the dissatisfaction in the community.” There seems to be interest and opportunity to voice community concern through different channels, which helps keeps chiefs accountable. In general, elders may not hold the same respect as in years past. As one chief stated, “The role of age has changed because the elderly are supposed to be like a dictionary that will help the children but they have failed.” In contrast to other PAs, the traditional laws seem to have less dominance in Wau, perhaps in part due to the ethnic and religious diversity and presence of refugees, and regular presence of foreign organizations.

**Figure 1.7**

![Major Institutions Affecting Households](image)

**Figure 1.8**

![Role of Traditional Leaders](image)
Only a small proportion (13%) of households in Wau are familiar with the humanitarian, development and service agencies in their region, yet over 20% of households stated that NGOs or other agencies affect their household (Figure 1.7); the difference may indicate data error or poor job by the agencies to properly introduce themselves. Especially since qualitative data demonstrated the vibrant impact that various organizations have on Wau communities, it’s possible that survey data may be limited in this respect. According to surveys, among households familiar with agencies, World Food Programme (WFP) is the most known, followed by FAO, UNICEF, and Red Cross. Figure 1.9 indicates the agencies familiar to households that know of at least one agency, bearing in mind that aware households are the minority.

**Figure 1.9**
CONFLICT AND RESOLUTION

Figure 1.10 indicates the pervasive social risks and threats of violence in Wau and other PAs, both domestically and outside the home. Compared to other PAs, the prevalence of households affected by social risks is relatively moderate in Wau.

Outside the home, households reported burglaries/robberies and gang activity as the most common risks. Within households, the strongly associated risks of alcohol abuse, domestic violence, child abuse and teen pregnancy are common, with particularly deleterious effects on women and children. More than 30% of households indicated rape was a prevalent social risk.
A small number of surveyed households (7%) identified tribalism as the main contributor to conflict, followed by firearms availability and civil war (Figure 1.12). Overall, households cited various causes, including conflicts over natural resources, especially forestry, oil and water (Figure 1.13). Most surveyed households believe dialogue and traditional leadership remain the primary methods to resolve disputes. Households identified lack of trust and seriousness as the primary bottlenecks to conflict resolution, as well as greed and dishonesty among conflicting parties, and external influence (Figure 1.11). The role of political greed and external influence may relate to natural resource conflicts (Figure 1.13).

Responses from focus groups and interviews echoed survey data reference to the threats from gender-based violence, resource-based conflicts, tribalism and firearms availability. Qualitative data revealed the constant threat of insecurity and effect of trauma. Insecurity traveling the roads, or when going out to cultivate crops was a common theme; fear and the threat of violence or theft paralyzes economic activity. Focus groups spoke quite eloquently about the need for counseling services—as well as the benefit of...
trauma healing from cultural activities such as sports, dance and drama. A focus group called for “military tools like guns to be kept far from citizens’ eyes. Because even if they are here to protect, the citizens will be afraid just by seeing them.” Comments highlighted the disproportionate fear that women experience, and the real consequence of gender violence, domestic abuse and rape, and importance of creating “awareness” of hidden traumas and making space for healing—for men and women alike. “Especially when it comes to the men, they would rather stay silent even when they are raped than attend counseling. They fear to be seen as weak and maybe lose their wives.”

Qualitative data also revealed importance of youth in conflict: Youth in most cases are manipulated to support conflicts at the front lines. When they are idle, they will join [a conflict] because they have nothing better to do.” A female focus group expressed concern about rumors spread through Facebook and social media, as well as youth drug use and street gangs known as niggas. Children may run away from home due to conflict within homes. “Now we have many homeless children growing up on our streets and sadly some are girls. These children are forming street gangs which we didn’t have before.” Parents expressed concern for safety: “We are worried about our children’s safety here, a week ago a child of 12 was killed during a fight between these nigga groups.” Refugee camps may offer relief in time of crisis, but also disrupt normal lives and livelihoods, and introduce adolescents to new situations and behaviors, including risk of early pregnancy. “When the children are at the camps their behavior changes and they pick up new habits, so, they returned changed from before—there has also been an increased number of cases of early pregnancies in the girls returning from camps. You will find girls as young as 14 or 15 pregnant or having a child.”

Domestic strife is the undercurrent of political and tribal conflict. One chief indicated “You will find husbands and wives fighting and killing each other.” It is reported that tensions have arisen due to shifting gender relations; according to one chief “if the woman has a small business and earns some small income and you the man don’t have, then she will not listen to you. This is what has caused widespread marital problems.”

Like many PAs, Wau faces land conflicts, especially between farmers and pastoralists. The government had attempted to address this issue: “There was a conference of farmers and cattle keepers in Maria Bai to resolve a conflict” though these efforts are not always successful, especially due to prolific firearms among cattle owners. Some blame politicians as the main drivers of conflict between the farmers and pastoralists. Focus groups also echoed that tribalism is a factor “limiting services from reaching our community places. These services are delivered with segregation.”

Many comments insinuated corruption, and that “oil revenue was used to buy guns. Few people have benefited from oil revenue leaving a lot of people suffering economically.” Comments also identified a politicization of curriculums, and movement of people groups: “They have changed the map showing where people lived before we separated in order to explain their political and tribal agenda.” Some comments indicated a certain lack of trust in some outside mediators: “Why can’t the people of South Sudan be their own mediators and negotiate a lasting peace, why do we need people to come from the international community?”

In terms of conflict resolution, focus groups praise the effect of diverse activities, such as music, dance and drama that promote peace and reconciliation. “Tribes are coming to perform traditional dance with one spirit, one people not different tribes.” Many actors, counselors and institutions participate in reconciliation: “Some disputes are settled from police departments, schools and health related disputes are settled by health centers,” -- or athletics: “When the youth play football together, they will develop a friendship that will keep them from fighting as tribes.” Some also encouraged intermarriage to promote peace between tribes.
Most of households identified death, civil war and retaliation fears as the primary effects in their community (Figure 1.15). Roughly 60% of men and women feel safe during the day in their communities, and somewhat few feel safe at nighttime (Figure 1.16). Qualitative data also echoed the felt sense of fear and trauma’s hold on communities. Though the psychological trauma and mental health disorders that stem from conflict, violence and social risks are difficult to quantify, they will likely play a major role in household and community resilience (Michalopoulos et al., 2015).
1.3 ACCESS TO BASIC SERVICES

EDUCATION

Compared to other 7 PAs, Wau has moderate-to-high rates of literacy and household members that have been to school. Like other PAs, the difference between male and female literacy and education rates is severe. Overall, low literacy (Figure 1.18) and education rates (Figure 1.19) in the PAs are associated with communities where a larger percentage of households live more than 5 km from a primary school (Figure 1.20) and where no secondary school exists (Figure 1.21), even though these communities often identified cultural barriers, not school distance, as the predominant reason not to attend school (Figure 1.22). Qualitative responses (below) reveal more nuanced perspectives on the barriers to school attendance. In Wau, most schools are government-funded, run by FBOs or privately-owned (Figures 1.23 and 1.24).

**Figure 1.18**

![Adult HH Members that Can Read & Write (%)](image)

**Figure 1.19**

![Household Members that have ever been to school (%)](image)
Conflict has serious implications on education. Qualitative data highlight complaints of how the conflict has closed schools, raised costs and robbed remote communities of quality teachers, and parents of incomes to pay school fees. Children left orphans after the conflict often can no longer afford school fees. Several comments point out the government’s inability to motivate teachers: poor pay and protection of teachers in remote place as forced many schools to close. “The government is still not providing for children after this conflict and even taking money from schools.” Many youth focus groups expressed the desire for education and called on the government to “provide free schooling, which would give morale to children and keep children off the streets.” NGOs were praised for their role in education: “Organizations have been helping people in education by providing books and encouraging education of the girl child.”

Like other PAs, there was tension around the issue of language in school: the emphasis on English and Arabic often at the cost of local languages. Others respected the government’s prioritization of these languages: “For example, in Bisella community, there is a Dogo Elia language which unites all people. If the ministry were to say, Balanda language, Jur or Dinka languages be taught there automatically the community will say no…Yes the policy is correct but the community has a right to choose the language to teach their children. That is one of the decisions or policies the community may refuse.”

Girls complained that “early marriages can derail you and hinder you from achieving your goals.” Community leaders and organizations note that schools provide leadership and direction for youth—potentially keeping them out of conflict. Because of the severe cost barriers to education, organizations could consider facilitating non-cash-based options to pay teachers or school fees in situations where exchange of goods or services may be appropriate. Motivated youth may also be invested in community popular education; one youth focus group called for kids to teach one another: “The kids should help each other to learn what they missed in school. If they are unable to study, those who are studying should help teach them in the evening. Try hard to teach each other with the little resources available.”

**HEALTH**

Relative to other PAs, households in Wau have experienced the highest quality health care services. Eighty to ninety percent of households are served by a qualified healthcare professional, received enough information during health visits, and are served on time (Figure 1.25).

Qualitative data demonstrated the strong role that NGOs play in providing health education and access, including for HIV, hepatitis B and other diseases: “They have worked to encourage people and give many teachings so that people don’t have to hide when a disaster has befallen them like rape cases, HIV, or any other diseases.” Nonetheless, geographic distance and insecurity traveling the healthcare services remain a major barrier, as do lack of medicines and crowding in hospitals. “Remote locations often prevent access to health services when the risk is too large for organizations…some places are very far and have conflicts; this raises fear in the organization and prevents counselors from going to such areas.” Education can continue to improve; for example, “the citizens don’t know which organizations are providing treatment for a specific illness, and where to find them. Also, which diseases are still treated by the government. They don’t know their rights to health services.”

Though quality of care in Wau may be higher than other PAs, there may also be economic tension fostered by labor inequities between health care providers: “Nurses working for some organizations are paid well in dollars, but others are paid poorly in South Sudan Pounds (SSP), which has caused a big problem.”

Qualitative data spoke as urgently about mental health as physical health: “A lot of people suffer from trauma in our community and this affects health directly because we don’t have doctors of psychology.” Many mental health services are through FBOs or NGOs: “The community has also made centers for counseling like at the churches. At these centers people are able to go and talk about their issues freely.”
encouraged “people receiving counseling could show other victims that they are not alone and there are people like them living positively because of counseling” – to speak about their experience to others, and on social media “so others learn what to do.” While not technically health services, it’s clear that music and drama play a healing role in Wau communities: “We have the theatre where people can go sing, so it can help the youth forget about all the problems.” The mental and social health role of the arts should not be underestimated in Wau.

**Figure 1.25**

![Quality of Healthcare Services](image)

**WATER**

While multiple water sources may be available in each community, most households depend on one or two primary sources. Hand pumps and vendor wells or open water provide the predominant water sources in Wau (Figure 1.26). Most households travel less than 15 minutes to the available water source (Figure 1.27).

Qualitative data highlight concern for the high costs of water access and the contamination health concerns. More than other PAs, there seemed to be strong awareness of the potential health risks associated with sanitation and water contamination – likely due to education from outside organizations. Focus groups mentioned that “organizations are now providing awareness on boreholes water,” and “distributing chlorine tablets to help with treatment of the water,” and “teaching citizens on how to clean both the drinking water and the utensils.” Government has intervened in water and sanitation, giving “out permits in order to help monitor the cleanliness of the containers used for the water.” Waste hills around the residential areas also require intervention from the government.
Figure 1.26

![Main Water Source](image1)

Figure 1.27

![Travel Time to Water Source](image2)
QUALITY OF GOVERNMENT SERVICES

The seven PAs generally have a poor view of government services (Figure 1.28), and Wau is no exception. Wau’s population in particular complained about poor job creation, poor transportation infrastructure and lack of equity and poverty (Figure 1.29).

Focus groups echoed the complaints of poor transportation infrastructure—both the road quality and threat of violence/theft by traveling. Many complained about inflation induced by the depreciation of local currency with respect to dollar, the need to reach distant rural communities with services, and the lack of schools and hospitals. They also complained of corruption and lack of accountability: “Ever since we got our independence and became a country, there has been a lot of money from the government to build roads but this hasn’t been done. So, if there is real accountability, then things will definitely move forward.”

Some government officials are a “barrier to service delivery because they keep the services for themselves instead of distributing them to the vulnerable groups.” Nonetheless, commentaries expressed mixed opinions of the government, including the belief that the government was doing what it could to serve the people and bring peace.

Figure 1.29. Rating of Government Services

Figure 1.28

Rating of Government Servies, Wau
1.4. PRODUCTIVE CAPACITIES

FOOD INSECURITY AND AGRICULTURAL PRODUCTION

Most households in the seven PAs experience lack of food over a 12-month period. Comparatively, Wau’s food insecurity rate of 36% was the least severe among all 7 PAs. Civil war and conflict are the main drivers of food insecurity in Wau (Figure 1.30). Because over 20% of lack of food causes were identified as “destroyed by unknown,” further research in Wau is required to unveil and ultimately eradicate the unknown causes.

**Figure 1.30**

Most households responded to food insecurity by relying on relatives or NGOs, including primarily WFP. Some purchased food, and a small percentage gathered wild plants and animals (Figure 1.31).

**Figure 1.31**

In addition to social and environmental factors that inhibit food security (Figure 1.30), additional human activities disrupt ecosystems, which threatens food security, human health and livelihoods. Some mining, toxic dumping and fishing chemicals affect Wau, but bush-burning and charcoal burning are rampant, and over-grazing and timber lumbering are common (Figure 1.32). These human activities threaten resilience by deteriorating soil structure, decreasing agricultural productivity and biodiversity, and exacerbating erosion and runoff pollutants (Ozaslan et al., 2015; Vagen et al., 2005). Despite the obvious present value of bush burning and timber lumbering, they have various deleterious future effects, so efforts must be
made to prune, plant and preserve – and encourage applied agroecological or agroforestry knowledge that enhances food security by building healthy soils and ecosystems. While it is difficult to make sweeping generalization about the impact of bush burning due the particularities of ecosystems and the intensity and regularity of burning, the potential effects can be devastating to soil erosion and soil inherent fertility—one of the foundations of food security resilience and flood and drought resilience (Omotayo & Chukwuka, 2009). Bush burning can severely diminish soil’s ability to absorb and retain water. Stripping soil of its sponge-like capacity worsens the impacts of both floods and droughts (Basche & DeLange, 2017; Hmielowski, 2018). The chemical changes from burning and the devastation to soil organic matter and plant biomatter in the ground exacerbate water repellency and erosion, stripping away topsoil as well as essential soil micronutrients, microbiota and fungal life (Hossner & Juo, 1999). Destroying shade systems can further heat and dry out soils, exacerbating erosion and salinization. Timber lumbering further threatens shade cover, roots systems and biodiversity resilience (Basche & Edelson, 2017). Previous interventions have demonstrated powerful economic, social and environmental benefits from farmers protecting and planting trees, in effect “re-greening” semi-arid regions (E van Walsum et al, 2014), which may be instructive for South Sudanese regions facing timber lumbering pressure. Strong efforts should be made to protect, prune and plant, so that the immediate financial benefits of these activities do not devastate alternative ecosystem-based livelihoods as well as future ecosystems, soil health, food security and resilience.

**Figure 1.32**

![Activities Destroying the Environment](image-url)
With respect to farming, all counties focus on carbohydrate-dense grains as the most important crops. Though sorghum and maize are the primary crops, households in Wau prioritize a higher diversity of crops than any other PA, likely due to their higher urban market access. Within households as well, there is greater diversity compared to most PAs; many households cultivate cassava, onions, simsim, groundnuts, maize, millet or sorghum in addition to their primary crop (Figure 1.34). Crop diversity may also explain why environmental effects did not compromise food security in Wau as severely as in other PAs (Figure 1.30). Lack of diversification can put households and communities at risk when particular crops or varieties fail, as well as compromise households’ dietary diversity. In contrast, agricultural diversification can reduce household and regional vulnerability to climate and market shocks (Brenda, 2011), and benefit health—provided households diversify with nutrient-rich crops and animal-source foods (Kennedy et al., 2010; Hoddinott et al., 2002). However, it’s important to note that only half of those surveyed in Wau participate in crop production, compared to 70-90% of those from other PAs. Residents of Wau appear to have far higher access to humanitarian food aid that other PAs, and have the lowest degree of food insecurity, compared to the other PAs.

**Figure 1.34**

Qualitative data also suggested that Wau cultivation is more diverse than other PAs, and that producers have access to buyers which may demand more diverse crops: “People easily come here usually in small cars, buy what they need and immediately go back.” Comments also indicate recent shifts toward more modernized agriculture “Before we would go and plant just enough crops to eat and then wait for next year. Now farming is done on a big scale.”
Focus group discussions reveal mixed desires for community self-sufficiency based on agriculture and the continual help from NGOs and outside organizations. Many comments praised the agricultural help from NGOs: “The training from the NGOs has been fruitful and meaningful and we have learnt a lot and enhanced our agricultural knowledge on modern agricultural methods.” Though commentaries praising NGOs’ role in food security seemed in tension with other expressed desires to be self-sufficient through agriculture: “Nobody is practicing farming so that they can benefit from it. Rather they are all depending on the food they are receiving from the organizations.” Many comments praised farming for food security at the community and household level, and the desire to return to self-sufficiency from the land: “If everybody returns to their home, they will carry out agriculture and cultivate food that will be enough to wipe out famine in the country.” One community leader stated “Agriculture, if we all cultivate, then I don’t think we’ll be in need of all these international NGOs. We would produce enough food for us and good business can flow and boost us financially.” Perhaps rooted in this desire for self-sufficiency, organizations like Community Empowerment for Progress Organization (CEPO) were praised for community classes: “it does not give you money nor food but gives you ideas that will better your community.”

Agricultural groups seem to be active, “We have around 20 agricultural groups in Agok, formed by Oxfarm organization,” and tied to (mostly) positive agency interactions “We have Oxfarm organization, which has helped us a lot. We also have what we call WATAP although their seeds are not good.” More than other PAs, Wau comments called for more modern machinery “tractors,” yet also stated that previously distributed machinery sat “broken and spoilt.” Unfortunately, many services and inputs do not reach all farmers. “Insecurity prevents agricultural tools from reaching the vulnerable people in the community.” There are also gender barriers: “The majority that come to trade for agricultural inputs are men not women. Maybe it’s because the women think it’s supposed to be done by men and not the women.”

Though survey data did not indicate that floods and drought were major obstacles to food security, many focus groups complained of their impact on food security and agriculture, and that “sometimes there are wild fires that burn most of the place.”

There appears to be some tension between government and farmer coordination: “The farmers make decisions, like in the middle of the dry season, the farmers meet without the government and come up with solutions to their problems.” And “The government makes some decisions because right now there is development in the agricultural sector and people can now use machines.” Nonetheless, a farmer focus group stated, “Of course you as a farmer knows what to plant this year. You have to plant what benefits you and your kids but not what someone told you to.”

LIVELIHOODS

Livelihood activities among Wau’s working population is highly differentiated by gender. Unlike the other PAs, merely half of adult males and females engage in crop production (fewer male youth, and data for female youth is missing). Females dominate the baking, retail, catering and food processing sectors, while males dominate construction, motor vehicle mechanic work and carpentry industries. Female youth are more likely than older women to work in tailoring and retail, but less likely to work in food processing and catering. Male youth are more likely that older males to work as motor vehicle mechanics, but less likely to work in construction and carpentry (Figure 1.35). Market livelihood activities varied less by gender. Petty trade dominates the market labor activities, with moderate representation from bodaboda driving, casual labor and alcohol brewing stand out as the dominant market livelihood activities (Figure 1.36).
Figure 1.35

Livelihoods, by demographic, Wau

- Others
- Construction
- Motor vehicle mechanics
- Carpentry
- Tailoring
- Bakery
- Retail
- Dairy processing
- Catering
- Food processing
- Livestock production
- Crop production

Women | Female Youth | Men | Male youth
Males and females of all ages in Wau generally agreed on the obstacles to livelihood activities, with the exception that youth complained more of lack of employment (Figure 1.37). All ages and genders identified insecurity as the primary livelihood obstacle.

Like the quantitative survey data, qualitative data revealed the paralysis of insecurity for economic activity, inhibiting trade, preventing producer from working in more remote cropland and creating an ambiance of fear. Like other PAs, focus groups indicated concern for inflation and prohibitively high food prices.
Gender concerns were expressed by focus groups: “the other issue is gender, cultural and tradition bias; for example, if you are a woman you can’t be promoted past a specific station.” At the same time, it was apparent there has been an evolution in women’s roles: “Before, women were working in kitchen, but now women are in offices and in every place.” And “I thank our government for allocating 35 percent representation of women in the constitution.” The presence of cooperatives was not overly apparent from qualitative data – however many comments addressed the importance of “networks of communication” – especially for women, including women involved in livelihood activities.

Comments also called for access to capital, including the need for loans and micro-finance, especially for women, “Sometimes with a good idea all one needs is a little capital to run a successful business. But where to get the startup capital is a problem.” Focus groups also complained of how high taxes suffocate small business activity that could positively impact communities, while lucrative extractive industries go un-taxed – despite the double opportunity to discourage their negative environmental impact and raise tax revenue. Comments called for NGOs to provide tools and agricultural machinery, to help boost local production, so that production would be more than enough to sustain communities’ food needs.

MARKET ACCESS

Only 66% of surveyed households have regular access to a common open market, though among those with access, nearly all (97%) have daily access. Most markets are both regional and local, potentially facilitating access to wider variety of foods and goods (Figure 1.38).

Figure 1.38

![Geographic Market Coverage](image)

Wau is the least crop dependent compared to other PAs; nonetheless, over half of working adults still cultivate crops. Also, in contrast to other PAs, Wau’s crop cultivation is relatively diverse across communities and within households. The diversity in cultivation may contribute to improved food security and more balanced and diverse diets. However, food aid (from WFP or other NGOS) is currently the primary option when households face food insecurity, and such humanitarian aid may not be sustainable in the future, nor support long term resilience.

Qualitative data underscore the ramifications of limited road access inhibiting trade, as well as confidence in agriculture: “I think agriculture can really boost livelihood, through international NGOs support in bringing in
seeds like beans, sorghum, simsim, and all types of vegetables and fruits.” The private sector also “carry out the role of bringing seeds from another country for those without seeds. For example, carrot seeds and some agricultural tools such as hoes, tractors will be brought from a far place...If such aid is successful, then big traders should be given loans in collaboration with international NGOs and work together.”

Many comments mentioned organizational trainings that helped prepare them to respond to shocks—though it was not always apparent whether these shocks were economic, environmental or political in nature. In this regard, a diversity of agricultural development methods should be considered since some regions—particularly remote communities vulnerable to shocks—may not be suited to conventional agricultural development practices. In the absence of well-functioning markets with consistent access to agricultural inputs and consumer demand, farmer adoption of typical production-enhancing technologies could weaken resilience over the long-term because many modern technologies fail to improve long-term soil health, and biodiversity-based pest management. In Wau, agroecological systems could simultaneously enable communities to improve desired self-sufficiency through agriculture and recuperate the inherent productivity of soils degraded by environmental destruction (Tittonell et al., 2011; Boyd et al., 2013). Higher forms of agroecology include both environmental and socio-economic components that could strengthen natural resources, livelihoods, and foster peace community relations (DeLonge et al., 2016). In some localized efforts, stronger gender and community relationships and farmer-to-farmer education go hand-in-hand with improved livelihoods and sustainable management of natural resources, demonstrating powerful socio-ecological-economic dimensions (Kerr et al., 2013; Gubbels, 2011). Holistic agroecology can offer protective measures for nutrition and food security, provide sustainable livelihoods, and foster healthy community relationships.

MEASURING AND EXPLAINING RESILIENCE

2.1. METHODOLOGY AND DATA

We adapt the FAO’s Resilience Index Measurement and Analysis-II (RIMA-II) methodology, which, along with its predecessor RIMA, has been implemented in around 15 African countries to estimate households’ ability to maintain well-being in the face of shocks (FAO, 2015; FAO, 2016). In RIMA and RIMA-II, resilience is estimated as an index, based on observed indicators of assets, livelihoods, and access to services and safety nets, which are organized into pillars.

It should be noted that whenever the RIMA/RIMA-II methodology is applied to cross-sectional data, it would be accurate to interpret the resulting measure in terms of capacity to prevent vulnerability rather than resilience per se. Indeed, because resilience is a dynamic concept, it usually is defined as the ability to maintain a minimum level of well-being despite stressors or shocks. Thus, it is best measured with panel or longitudinal data in which changes in well-being over time, as a result of shocks, are observed. In a cross-sectional setting, the RIMA-II methodology measures the contribution of different variables to current well-being (usually represented by food security outcomes), rather than measuring the maintenance or improvement of well-being over time as a result of shock. In the remainder of this section, we will refer to the latent variable estimated as “resilience,” but it is better understood as a capacity index associated with household and location characteristics, grouped under the pillars, which contribute to resilience and ultimately to the desirable well-being outcomes.

Figure 2.1 demonstrates the resilience measurement framework graphically.
Figure 2.1. Resilience measurement framework

Following the computation of the resilience index we use regression analysis to estimate the effects of household characteristics and other factors on resilience. To account for the social and institutional environment, we construct variables to represent the quality of governance as perceived by households, strength of institutions, and exposure to conflict, based on a set of underlying variables.

We apply the RIMA-II methodology to cross-sectional household survey data collected by Management Systems International (MSI) in the 7 Partnership Areas (PAs) in 2018 to estimate the resilience of households in Aweil. Like FAO, we use indicators of food security as the outcomes of resilience. Data were collected on household characteristics and livelihood sources; the availability of livelihood opportunities; weather shocks and conservation; food security and coping strategies; health and health care; community participation by women and children and community organization; violence and insecurity; conflict; and perceptions of the quality of governance and the causes of conflict. The variables constituting each pillar are listed in Table 2.1.

Note: BASIC—Access to Basic Services; SSN—Social Safety Nets; ADC—Adaptive Capacity; RES—Resilience; FCS—Predicted Food Consumption Score; Meals1—Per capita number of cooked meals consumed the previous day by children over 12 and adults; Meals2—per capita number of cooked meals consumed the previous day by children aged 6-12 years; Meals 3—Per capita number of cooked meals consumed the previous day by children aged 2-5 years.

1 The specific lists of variables used for resilience analysis in each PA are subsets of the list in Table 2, as some variables were dropped in some PAs due to missing values or other issues.
The variables used to construct the institutions, governance and conflicts scores are listed in Table 2.2. The governance score is composed of variables representing respondents’ perceptions of the quality of the governments’ performance in different areas, including creating jobs, reducing crime and corruption, improving access to education, etc. Thus, the governance score directly measures perceptions and can serve as a proxy for actual governance quality. For the conflict score, we use variables representing the presence or frequency of conflicts and violence, such that the higher scores are associated with more conflict and violence.

<table>
<thead>
<tr>
<th>PILLAR</th>
<th>INDICATORS</th>
</tr>
</thead>
</table>
| Access to Basic Services    | **Education:**
|                             | Distance to primary school
|                             | Distance to secondary school
|                             | Participation in vocational training
|                             | Existence of agricultural extension workers
|                             | **Markets:**
|                             | Access to a common open market
|                             | Market located along trade routes
|                             | **Health services:**
|                             | Number of health facility types where household members go when sick
|                             | Health facility provides free care
|                             | Time to reach the health facility
|                             | Respondent was satisfied with quality of health service
|                             | Respondent was served by a qualified person
|                             | Time spent waiting until attended to
|                             | Health provider treated respondent with respect
|                             | Respondent was served on time
|                             | Health personnel give respondent enough time
|                             | Respondent was provided with enough information
| Social Safety Nets          | Access to remittances from within South Sudan
|                             | Access to remittances from outside of South Sudan
|                             | Number of ways in which household overcame lack of food (e.g., food aid from WFP, government, friends and relatives, etc.)
|                             | Knowledge of organizations doing humanitarian / development work in the community
| Assets                      | Predicted landholdings
|                             | Predicted numbers of wheelbarrows; beds; sponge mattresses; chairs; tables; radios; televisions; cellphones; mosquito nets; motor bikes; bicycles; flat irons; stoves; solar panels
| Adaptive Capacity           | Educational attainment of household head
|                             | Number of types of fuel used by household for cooking
|                             | Number of agriculture-related livelihood activities household members are involved in
|                             | Number of non-agriculture-related livelihood activities household members are involved in
|                             | Number of formal employers of household members
|                             | Number of crop types planted in 2018
|                             | Access to information to warn about natural disaster
Following FAO (2016), we implement the RIMA-II methodology using four pillars: i) Adaptive Capacity, representing households’ ability to absorb and adapt to shocks and stressors; ii) Social Safety Nets, representing the availability of formal or informal social protection and other resources to lessen the impact of shocks; iii) Assets, representing a households’ physical assets and income; and iv) Access to Basic Services, indicating the households’ access to and use of services such as education, extension, markets, and health facilities. Since the MSI survey data does not include detailed information on assets, we used predicted values of household assets and landholdings based on recorded assets and landholdings of similar households in the same areas from data collected by WFP and FAO. For each PA, we use the WFP/FAO data to run truncated tobit regressions for landholdings and numbers of different assets owned (e.g., mattress, cell phone, bicycle, etc.), using as explanatory variables location attributes and household characteristics which are also recorded in the MSI data (e.g., age, sex and education level of household head, type of toilet, and main water source). We then use the regression results to predict level of each asset for households in the same PA in the MSI data, based on household characteristics. These predicted land and asset levels are used to calculate the Assets pillar.

The pillars are indices composed of several observed variables; the computed pillars are then used to estimate a resilience index as a latent variable. Theoretically, all pillars should contribute positively to household well-being via the latent variable measuring resilience. It should be noted that in practice, the construction of each pillar index is sensitive to the extent to which the indicators composing the pillar are correlated with each other. When pillar variables are negatively correlated, it becomes difficult to predict
the overall effect of the pillar on outcomes; for this reason, we drop variables if necessary to avoid negative correlations between pillar variables.

As pointed out above, the RIMA-II methodology as implemented by the FAO measures “food security resilience,” or the ability to maintain food security in the face of stressors and shocks; food security indicators are functions of resilience. The MSI data contains only one binary variable indicating whether a given household lacked food within the past 12 months. This variable has very little variation across households and thus is not very informative for the purposes of resilience analysis. The proportion of households which experienced lack of food in the past 12 months was over 75 percent in four out of the seven PAs, which reflects the widespread food insecurity in the priority areas.

Instead, we opted to use four predicted food security variables—the Food Consumption Score (FCS) and the numbers of meals consumed by different age groups—as food security outcome variables. The FCS measures the number of food groups consumed in the past 7 days; the variables on meals measure the per capita number of warm and cooked meals consumed in the previous day by children aged 2-5 years, children aged 6-12 years, and children over 12 and adults. The variables were measured in the data collected by WFP/FAO in the same PAs and were predicted for each household in MSI dataset based on the values of similar households in the WFP/FAO data using the methodology employed for the predicted Asset variables described above. In addition to the greater variation, the predicted variables offer richer information than the binary food security variable in the MSI data. Dietary diversity variables such as the FCS have been found to be good predictors of undernutrition indicators and to reflect the influence of shocks and stressors (Headey and Ecker, 2013).

2.2. PILLAR CONSTRUCTION

In Table 2.3, we report the weight of each variable in the Access to Basic Services pillar. Variables reflecting access vocational training and extension services play the strongest roles. Indicators of access to high-quality health care contribute less to the pillar. Households in Wau have low access to vocational training and extension services, with 5 to 9 percent of households reporting access to or usage of each service. In contrast, access to health care is relatively good, with over three-fourths of households reporting that their health facility provides free care; 90 percent of respondents were satisfied with the quality of health care received at their last visit. Two-thirds of the sample travel less than 30 minutes to reach their health facility.

<table>
<thead>
<tr>
<th>TABLE 2.3. ROLE OF VARIABLES IN PILLAR ESTIMATION: ACCESS TO BASIC SERVICES</th>
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</thead>
<tbody>
<tr>
<td>PILLAR VARIABLES</td>
</tr>
<tr>
<td>--------------------------------------</td>
</tr>
<tr>
<td>Participation in vocational training</td>
</tr>
<tr>
<td>Existence of agricultural extension workers</td>
</tr>
<tr>
<td>Time to reach the health facility</td>
</tr>
<tr>
<td>Health facility provides free care</td>
</tr>
</tbody>
</table>

2 Pillars are constructed using principal component analysis (see Annex); the weights of each variable are the factor loadings of the first factor.
3 Only variables used in the Wau analysis are shown in Tables 2.3-2.6. Additional variables shown in Table 2.2 were not used due to high numbers of missing values, negative correlations with other pillar variables, and other factors.
The Assets pillar (Table 2.4) is constructed from predicted landholding and numbers of household assets, based on asset holdings of similar households in the more detailed FAO-WFP dataset. The predicted numbers of flat irons and mosquito nets make the largest contributions to the overall pillar, followed by predicted landholdings. Most households were expected to own no mosquito nets or flat irons, and less than one half feddan of land.

<table>
<thead>
<tr>
<th>TABLE 2.4. ROLE OF VARIABLES IN PILLAR ESTIMATION: ASSETS</th>
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</thead>
<tbody>
<tr>
<td>PILLAR VARIABLES</td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>Predicted number of flat irons</td>
</tr>
<tr>
<td>Predicted number of mosquito nets</td>
</tr>
<tr>
<td>Predicted landholdings</td>
</tr>
</tbody>
</table>

Note: *1: Less than one half feddan; 2: Half to one feddan; 3: More than one feddan

The variables that contribute the most to the Adaptive Capacity pillar are those concerned with agricultural livelihood strategies: the number of agricultural livelihood activities and the number of crops planted (Table 2.5). The number of nonagricultural livelihood activities made the next largest contribution to the pillar, followed by access to information to warn of natural disasters. The number of formal employers made a negative and rather negligible contribution to the pillar, reflecting negative correlations between this variable and other variables composing the pillar; for example, this suggests that households with formal employment engaged in fewer alternative livelihood activities.

On average, surveyed households planted 1.6 types of crops, ranging from 0 to 7, and were involved in 1.2 agricultural livelihood activities, ranging from 0 to 5. The most common crops cultivated were sorghum, millet, and vegetables. Households were involved in an average of 0.9 nonagricultural livelihood activities, ranging from 0 to 5; around 70 percent of households were engaged in at least one nonagricultural activity. The most common nonagricultural livelihood activities included petty trade, bodaboda (bicycle or motorcycle taxi), charcoal burning, and brewing of alcohol. The majority of households derived income from informal activities, with only 41 percent of households having one or more formal employers. Very few households, less than one percent of the sample, had access to information warning of natural disasters.
Access to remittances from South Sudan carried the most weight in the Social Safety Nets pillar, followed by knowledge of organizations doing humanitarian or development work in the community; access to remittances from outside the country contributed negatively to the pillar (Table 2.6). Overall, access to social safety nets is quite low among surveyed households in Wau. A smaller share of households received remittances from outside South Sudan—3.1 percent—while 6.9 percent received remittances from within the country. Only 13 percent of respondents knew of international or national organizations doing work in their community, suggesting that the presence of humanitarian and development organizations is limited in Wau.

### 2.3. RESULTS AND DISCUSSION

The results of the structural equation model for Wau are presented in Table 2.7. As expected, the estimated resilience capacity index has a positive effect on food security, as measured by the predicted numbers of household meals consumed and by the predicted Food Consumption Score (FCS). Resilience has the largest impacts on the number of meals consumed by the youngest age group (children 2–5 years old).

Of the four pillars, only Access to Basic Services and Adaptive Capacity have significant effects on the resilience index. The effects of the pillars on resilience are not linear; the negative coefficients on the
Access to Basic Services and Adaptive Capacity pillar scores and positive coefficients on the square terms indicate that the pillar scores have quadratic relationships with the resilience score. This suggests the existence of threshold values that must be reached before increases in the pillar values begin to affect resilience positively.

| Table 2.7. Resilience Structural Equation Model Results for Wau |
|---|---|---|---|---|
| Variables | (1) Resilience | (2) FCS | (3) Meals1 | (4) Meals2 | (5) Meals3 |
| BASIC | -0.301* (0.172) | | | | |
| BASIC2 | 0.280* (0.169) | | | | |
| ASSET | 0.141 (0.101) | | | | |
| ASSET2 | -0.115 (0.168) | | | | |
| SSN | 0.0414 (0.106) | | | | |
| SSN2 | -0.0408 (0.149) | | | | |
| ADC | -0.195** (0.0780) | | | | |
| ADC2 | 0.193* (0.103) | | | | |
| Resilience | 1 (0) | 0.904*** (0.0798) | 0.833*** (0.0707) | 1.605*** (0.115) | |
| Constant | 0.664*** (0.0455) | 0.444*** (0.0411) | 0.565*** (0.0378) | 0.789*** (0.0717) | |
| Observations | 641 | 641 | 641 | 641 | 641 |

LR test of model vs. saturated: chi2(14) = 109.67, Prob > chi2 = 0.0000
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: Pillar variables are expressed as indices ranging from 0 to 1. BASIC—Access to Basic Services; SSN—Social Safety Nets; ADC—Adaptive Capacity; RES—Resilience; FCS—Predicted Food Consumption Score; Meals1—Predicted per capita number of cooked meals consumed the previous day by children over 12 and adults; Meals2—Predicted per capita number of cooked meals consumed the previous day by children aged 6-12 years; Meals 3—Predicted per capita number of cooked meals consumed the previous day by children aged 2-5 years.

To estimate the response of resilience to the change in each pillar, we compute elasticity of the resilience score with respect to each pillar (Figure 2.2). Elasticities are positive for the Adaptive Capacity and Access to Basic Services pillars—for each pillar, a one percent increase in the pillar value can be expected to increase the resilience index by 0.23 percent and 0.18 percent, respectively.

4 Of the following functional form $y = a + bx + cx^2$; it follows that elasticity is given by $(b + 2cx) * \frac{x}{\bar{y}}$, where $\bar{x}$ and $\bar{y}$ are averages.
As expected, the elasticities of food security measures with respect to the resilience score are positive (Figure 2.3). The numbers of meals consumed by young children and by older children and adults are the most responsive to increases in resilience, followed by the Food Consumption Score and the numbers of meals consumed by children aged 6-12.
Box 1. Drivers of Resilience: Pillars and Underlying Variables

The four pillar scores represent households’ attributes in the areas of Access to Basic Services, Assets, Adaptive Capacity, and Social Safety Nets, respectively. Each pillar is calculated based on indicators reflecting aspects of the overall concept represented by the pillar. For households in Wau, the Adaptive Capacity and Access to Basic Services pillars are found to contribute significantly to the resilience capacity index. However, the effects of increases in the pillar values on resilience are not linear: each pillar has a threshold value which must be reached before increases in pillar values begin to affect resilience positively. Increases in Adaptive Capacity have somewhat higher impacts on resilience than increases in Access to Basic Services. However, many households have pillar scores which are too low to have contributed to increasing their resilience: average pillar scores are below the threshold values for both pillars, with a larger gap for the Adaptive Capacity pillar and a relatively small gap for the Access to Basic Services pillar.

While social safety nets should normally be expected to increase households’ resilience, there are several reasons for which the analysis might fail to capture these effects. In particular, the presence of social safety nets may be more pronounced in areas or for households with lower resilience. The social safety nets pillar is constructed from variables on remittances received by households; migration rates and therefore remittances received may be higher among poorer households. If the resilience-strengthening benefits of the remittances are not enough to outweigh the households’ overall lower resilience, then higher levels of social safety nets could be associated with lower resilience scores. Greater asset levels would normally be expected to contribute positively to resilience as well. The lack of impact of the Assets pillar may be related to low levels of household assets among surveyed households.

To better understand how to increase resilience, it is important to look at the variables making up the Adaptive Capacity and Access to Basic Services pillars and their weights in the pillar scores, which reflect their relative importance. The variables that contribute the most to the Adaptive Capacity pillar are those concerned with agricultural livelihood strategies: the number of agricultural livelihood activities and the number of crops planted. The number of nonagricultural livelihood activities and access to information to warn of natural disasters also contribute to the pillar. Variables reflecting participation in vocational training and access to extension services play the strongest roles in the Access to Basic Services pillar. Travel time to the health facility, access to free care at the health facility, and households’ satisfaction with the quality of health services also contribute to the pillar.

As shown in Figure 2.4, female-headed households in Wau have worse outcomes than male-headed households for most of the food security indicators. The disparity is particularly stark for dietary diversity, with average FCS values for female-headed households less than half those of male-headed households. Female-headed households also had moderately lower numbers of meals consumed for children over 12 and adults and for children 2-5 years. However, female-headed households have similar scores on the two pillars which positively affect resilience, Access to Basic Services and Adaptive Capacity.
Figure 2.4. Average pillar values and food security scores for male- and female-headed households

Source: Authors.
Note: BASIC—Access to Basic Services; SSN—Social Safety Nets; ADC—Adaptive Capacity; FCS—Food Consumption Score; Meals1—Per capita number of cooked meals consumed the previous day by children over 12 and adults; Meals2—per capita number of cooked meals consumed the previous day by children aged 6-12 years; Meals 3—Per capita number of cooked meals consumed the previous day by children aged 2-5 years.

The majority (86 percent) of surveyed households in Wau identified themselves as Catholic, and 9 percent identified as Muslim. The remaining 5 percent were Pentecostal, Anglican and Adventist. Muslim households had somewhat lower scores for the Access to Basic Services and Adaptive Capacity pillars, while Pentecostal, Anglican and Adventist households had higher scores. Performance on the food security variables was mixed (Figure 2.5). Catholic households had higher FCS values than Muslim households but lower numbers of meals consumed by older children and adults; Catholic and Muslim households had similar values for the numbers of meals consumed by the other two age categories. Pentecostal, Anglican and Adventist households showed higher numbers of meals consumed by older children and adults, but had lower scores on the other food security indicators.
The large majority of surveyed households are located in two payams, with 52 percent in Wau South payam and 48 percent in Wau North payam. Catholic households are distributed fairly evenly between the two payams, but two-thirds of Muslim households live in Wau North. Households in Wau North performed consistently better on all food security indicators (Figure 2.6). They also had slightly higher pillar values for the Access to Basic Services pillar, but lower values for the Adaptive Capacity pillar.
Figure 2.6. Average pillar and food security values by payam

Source: Authors
Note: BASIC—Access to Basic Services; SSN—Social Safety Nets; ADC—Adaptive Capacity; FCS—Food Consumption Score; Meals1—Per capita number of cooked meals consumed the previous day by children over 12 and adults; Meals2—per capita number of cooked meals consumed the previous day by children aged 6-12 years; Meals 3—Per capita number of cooked meals consumed the previous day by children aged 2-5 years.

2.4. RESILIENCE DETERMINANTS

To understand the determinants of resilience beyond the pillar variables used to estimate the resilience score, we perform regression analysis using household characteristics as well as scores representing the quality of governance and the presence of conflict (Table 2.8). We first standardize the resilience score so that all values fall between 0 and 1. As expected, based on the findings discussed above, female-headed households show significantly lower resilience than male-headed households, reflecting these households’ lower performance on most of the food security indicators (Figure 2.4). This echoes the findings of previous RIMA analyses in the Karamoja region of Uganda and in Somaliland, which found female-headed households to have lower resilience scores in most areas (FAO, 2017; FAO, 2018).
Religion is not associated with differences in resilience, but geography is, with significantly higher resilience among households in Wau North payam compared to Wau South. The positive effect associated with Wau North is larger in magnitude than the negative effect for female-headed households. The only other variable showing significant effects on resilience is the age of the household head: households with heads of over 55 years had lower resilience than households with the youngest heads aged 25 and under. The conflict and governance scores do not significantly affect resilience in Wau.

### Box 2. Drivers of Resilience: Demographics and Environmental Variables

Household demographic characteristics also affect their resilience. Female-headed households have lower resilience than male-headed households, despite similar pillar scores. Female-headed households also show lower values for most food security indicators, particularly for household dietary diversity. Households with the oldest heads, aged 55 and over, have significantly lower resilience than those with the youngest heads of under 26 years. Geography is also associated with differences in resilience, with significantly higher resilience among households in Wau North payam (the administrative division below county) compared to Wau South payam. The analysis also tested the effects of environmental factors—namely the quality of governance and exposure to conflict—on household resilience; however, these factors were not found to significantly impact the resilience index in Wau.

### **TABLE 2.8. DETERMINANTS OF RESILIENCE**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>-0.0495***</td>
<td>(0.0193)</td>
</tr>
<tr>
<td>Age 26-35</td>
<td>-0.0146</td>
<td>(0.0430)</td>
</tr>
<tr>
<td>Age 36-55</td>
<td>-0.0347</td>
<td>(0.0404)</td>
</tr>
<tr>
<td>Age &gt;55</td>
<td>-0.1799***</td>
<td>(0.0427)</td>
</tr>
<tr>
<td>Muslim</td>
<td>-0.0274</td>
<td>(0.0305)</td>
</tr>
<tr>
<td>Other Religions</td>
<td>0.0161</td>
<td>(0.0502)</td>
</tr>
<tr>
<td>Wau North</td>
<td>0.0756***</td>
<td>(0.0181)</td>
</tr>
<tr>
<td>Other payams</td>
<td>-0.315</td>
<td>(0.226)</td>
</tr>
<tr>
<td>Conflict</td>
<td>-0.0264</td>
<td>(0.0837)</td>
</tr>
<tr>
<td>Governance</td>
<td>-0.0554</td>
<td>(0.0451)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.681***</td>
<td>(0.0447)</td>
</tr>
</tbody>
</table>

Observations: 608

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
INTERVENTION OPTIONS

As shown in Figure 2.7, there are many ways to improve food security by improving household resilience. However, for Wau, bridging the gap between current resilience level and the minimum required should be the first step. Accordingly, for each pillar, we calculate the required values to achieve minimum resilience (Figure 2.7). With observed pillar scores normalized to fall between 0 and 1, the minimum values required to affect resilience are 0.50 for Adaptive Capacity and 0.54 for Access to Basic Services. Average pillar values are below the thresholds required to increase resilience for both pillars. This illustrates the relatively low resilience of the surveyed households and the scale of the efforts required to increase resilience and ultimately improve food security in Wau. Average pillar values represent 88 percent and 60 percent of the threshold value for the Access to Basic Services and Adaptive Capacity pillars, respectively. Policymakers may wish to prioritize efforts to improve the indicators related to the Access to Basic Services pillar, as this pillar both has a strong effect on increasing resilience and represents an area in which a large number of households may be relatively close to threshold levels. Improving indicators that contribute to the Adaptive Capacity pillar is also an important area for attention, as this pillar has the strongest effect on resilience as suggested by its elasticity (Figure 2.2).

Figure 2.7. Threshold and average pillar values

Source: Authors, from modeling results
Note: BASIC—Access to Basic Services; ADC—Adaptive Capacity

Figure 2.8 provides the complete pathway to resilience and food security for Wau. The listed variables define the number, magnitude and nature of pathways policymakers and development partners ought to consider when planning to improve food security by increasing household resilience.

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5 With resilience estimated according to the following functional form \( y = a + bx + cx^2 \), it follows that the minimum value of \( y \) corresponds to \( x = -\frac{b}{2c} \). This \( x \) value is the threshold after which increases in \( x \) begin to affect the value of \( y \) positively.
Figure 2.8. Estimated pathways to resilience and food security

<table>
<thead>
<tr>
<th>Pillar variables</th>
<th>Weights</th>
<th>Pillar variables</th>
<th>Weights</th>
<th>Pillar variables</th>
<th>Weights</th>
<th>Pillar variables</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of crop types</td>
<td>0.733</td>
<td>Participation in vocational training</td>
<td>0.552</td>
<td>Remittances from S. Sudan</td>
<td>0.085</td>
<td></td>
<td></td>
</tr>
<tr>
<td>planned</td>
<td></td>
<td>Existence of agricultural extension workers</td>
<td>0.629</td>
<td>Knowledge of dev./hum. orgs.</td>
<td>0.072</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of ag livelihood activities</td>
<td>0.725</td>
<td>Time to reach the health facility</td>
<td>0.290</td>
<td>Remittances from outside S. Sudan</td>
<td>-0.126</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of non-ag livelihood activities</td>
<td>0.448</td>
<td>Health facility provides free care</td>
<td>0.138</td>
<td>Predicted no. of flat irons</td>
<td>0.883</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Info. about natural disaster</td>
<td>0.281</td>
<td>Respondent satisfied with quality of health service</td>
<td>0.222</td>
<td>Predicted no. of mosquito nets</td>
<td>0.754</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of formal employers</td>
<td>-0.056</td>
<td></td>
<td></td>
<td>Predicted landholdings</td>
<td>0.486</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
REFERENCES


FAO (Food and Agriculture Organization of the United Nations). 2016. RIMA-II: Resilience Index Measurement and Analysis II. Rome: FAO.

FAO. (2016). RIMA-II: Resilience Index Measurement and Analysis II.


ANNEX: DETAILED METHODOLOGY

We estimate the resilience measure in two steps, first by constructing the pillars from observed data, and second by estimating the resilience index based on the pillars and outcomes. We estimate the pillars using principal component analysis (PCA). Given that the variables composing the pillars are discrete, we first estimate polychoric correlations between the variables and then apply PCA to the correlation matrix.6 The pillars are then standardized using the min-max procedure7 so that all values fall between 0 and 1.

Following the pillar estimation, we estimate resilience as a latent variable based on the pillars and on four food security variables using structural equation modeling and a maximum likelihood estimator. We include the quadratic terms for each pillar to allow for the existence of thresholds, or minimum values required before an increase in a pillar value affects resilience. A resilience score is generated for each household and then standardized so that values fall between 0 and 1, with higher scores indicating greater resilience.

The mathematical expression of the RIMA framework is as follows (FAO, 2016):

\[ y = \lambda \eta + \varepsilon \]  
\[ \eta = \beta x + \zeta \]

where \( \eta \) is the latent variable representing resilience; \( y \) is an indicator or outcome of resilience; and \((x_1, x_2, ..., x_n)\) are the determinants of resilience. In our analysis, as in typical RIMA-II analyses, food security indicators are used as \( y \) variables and the four resilience pillars enter as the \( x \) variables.

Following the computation of the resilience score, we perform regression analysis using tobit to estimate the effects of household characteristics and other factors on resilience, while controlling for payam (the administrative division under counties) specific effects. To account for the social and institutional environment, we construct variables to represent the quality of governance, strength of institutions, and exposure to conflict, using polychoric principal component analysis to estimate scores based on a larger number of underlying variables, as was done to calculate the pillars.

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6 Standard methods of performing factor analysis (i.e., those based on a matrix of Pearson’s correlations) assume that the variables are continuous and follow a multivariate normal distribution. If the model includes variables that are dichotomous or ordinal a factor analysis can be performed using a polychoric correlation matrix. See Kolenikov and Angeles (2009) for a discussion of the advantages of using polychoric correlations when performing PCA on discrete variables.

7 \((Z-Z_{\text{min}})/(Z_{\text{max}}-Z_{\text{min}})\)