

**FARMER RESILIENCE**

*UNDERSTANDING AND MEASURING ONE ACRE FUND PROGRAM  
IMPACT IN SIX COUNTRIES*



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July, 2018**

## EXECUTIVE SUMMARY

Each year, One Acre Fund rigorously measures the program impact on farmer profit by comparing agricultural revenue to input costs for both program participants and comparison farmers. Over time, we have expanded our concept of impact to move beyond immediate farmer profit to other areas that are not easily monetized but entail meaningful changes in farmers lives. One such area is farmer resilience.

One Acre Fund’s farmer clients live an existence close to the margins, and our intention is that program impact on farm profit helps bring these farmers into a more stable and prosperous existence. To ensure the sustainability of our impact and continuing prosperity of our clients, it is important that we are able to meaningfully build our clients’ resilience and their capacity to withstand shocks and stressors. This study is an attempt to understand One Acre Fund’s impact on farmer resilience across all countries in which we operate.

### Methodology

**Creating the Resilience Score:** For our main strategy we draw on similar organizations’ work as well qualitative research with One Acre Fund farmer clients to define resilience, and we measure this through a set of 14 proxy indicators that feed into the final resilience index. The final resilience capacity score is a weighted average of all 14 indicators normalized between 0-1. By using a single resilience capacity score, we are able to undertake a single hypothesis test to measure our impact on our clients’ resilience.

**Resilience Capacity Index Pillars:** We have identified five key pillars that can predict the farmers’ resilience. These are: food access, assets owned, good agriculture practice and diversity, adaptive capacity and social networks. Each pillar is composed of around 2-4 indicators.

1. Food Access	2. Assets Owned	3. Agriculture Practice & Diversity	4. Adaptive Capacity	5. Social Networks
Measures the extent the HH can feed themselves with existing grains from crops grown on their farm in the previous season without relying on other means.	Looks at HH’s accumulated savings and the value of tradable physical and livestock assets. Also captures diversification of assets .	Measures if the farmer is using practices that can insulate their farm income, to the extent possible, from agricultural shocks.	Adaptive capacity relies on being able to redistribute strategies to respond to a changing environment.	Use proxy variables to measure farmer networks. We assume a HH with larger and deeper networks can ‘fall back’ on their network’s support if needed.
<b>Example indicators:</b> - Whether household is eating food from harvest during hunger	<b>Example indicators:</b> - Total value of tradable assets - Total Savings/Financial	<b>Example indicators:</b> - Using good agricultural practices that drive	<b>Example indicators:</b> - % Of school-age children in HH who are attending school	<b>Example indicators:</b> - Whether farmer is part of ROSCA/Merry go

season - # Kg of staple grain per acre available from harvest during hunger season	assets owned	higher maize yields. - Crop diversity index. Higher weight to a more diverse and equally distributed crop mix.	- % of HH members sick in last week, - If HH has more than 2 income sources	round/ Savings Groups - Whether respondent can rely on someone to borrow a small bag of 5 kg maize?
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**Defining the Treatment and Control Groups:** Veteran One Acre Fund farmers (client who has at gone through at least one year of program participation) serve as our treatment group for this study. Although we would have preferred to use a consistent selection method for the control group, this varies by country owing to unique factors in each country. In Kenya, Tanzania, Uganda and Malawi we use new One Acre Fund farmers (first time enrolled into the program but have not yet reaped the benefits of the program at the time of survey) as the counterfactual group. Since these farmers have self-selected into the program, we believe them to be a highly comparable group to the veteran One Acre Fund farmers. In Burundi and Rwanda, there is paucity of new One Acre Fund farmers living in the same geography in many areas due to high program saturation. Instead, in these two countries we use randomly selected non One Acre Fund farmers who are living in the same geography as veteran One Acre Fund farmers but have never enrolled into the program. To control for the selection bias in these countries, we use propensity score matching to help reduce the differences between non-One Acre Fund group and the treatment group.

## Findings

**Resilience Score:** We find that the program contributed towards an increased resilience capacity across all countries of operation where we conducted this study. One Acre Fund impact on resilience capacity (as measured) can be understood as an increase in resilience capacity by 2% pts. - 6% pts. compared to control farmers. The table below outlines the average resilience score for all groups measured.

Country	Rwanda		Burundi		Kenya		Tanzania		Uganda		Malawi	
	One Acre Fund	Non One Acre Fund	One Acre Fund	Non One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund
<b>Average Scores</b>	0.46	0.42	0.37	0.32	0.44	0.4	0.4	0.36	0.42	0.36	0.47	0.45
<b>One Acre Fund Impact</b>	<b>0.04 4% pts.</b>		<b>0.05 5 % pts.</b>		<b>0.03 3 % pts.</b>		<b>0.04 4% pts.</b>		<b>0.06 6% pts.</b>		<b>0.02 2% pts.</b>	

Although we find similar increases in resilience capacity for clients across One Acre Fund countries, there is a divergence in the sub-indicators that contribute to the increased resilience capacity. The heat map below shows a quick overview of the varying degrees of impact noticed across the pillars.

As expected, we find strong program impact on food access, which is the first link in the One Acre Fund theory of change (see Annex A), in all countries of operation barring Malawi, which has had challenges with both floods and droughts during the data collection period. The countries are ordered by program size which also corresponds to the time in which One Acre Fund has operated in each country. We do see, unsurprisingly, that older countries are relatively stronger in promoting resiliency than newer countries. Given the program’s strong focus on improving planting practices for enrolled farmers, it is not surprising that in established program countries (Kenya, Rwanda, Burundi and Tanzania), veteran One Acre Fund clients were more likely to follow the context specific planting practices than non-One Acre Fund farmers. In countries like Burundi and Rwanda where farmers naturally grow a variety of crops, program participation seems to have further contributed to increased crop diversity. Comparatively, farmers in Kenya and Tanzania score lower in terms of crop diversity – possibly because of their higher dependence on maize. We do however find clients in Kenya starting to have a more diversified crop based as a result of the program.

	Food Access	Assets Owned	Agricultural Practice	Crop Diversity	Adaptive Capacity	Social Networks
Kenya	Impact on most indicators	Impact on some indicators	Impact on most indicators	Impact on some indicators	Impact on some indicators	Impact on some indicators
Rwanda	Impact on some indicators	Impact on most indicators	Impact on most indicators	Impact on most indicators	Impact on some indicators	Impact on most indicators
Burundi	Impact on most indicators	Impact on most indicators	Impact on most indicators	Impact on most indicators	Impact on some indicators	Impact on most indicators
Tanzania	Impact on some indicators	Impact on some indicators	Impact on most indicators	No impact	Impact on some indicators	Impact on some indicators
Uganda	Impact on some indicators	Impact on most indicators	Impact on most indicators	No impact	Impact on some indicators	No impact
Malawi	No impact	Impact on some indicators	Data not collected	No impact	Data not collected	Impact on some indicators

Impact on most indicators	No impact
Impact on some indicators	Data not collected

One Acre Fund farmers in Rwanda, Tanzania and Uganda accumulated more tradable assets (in terms of overall value)<sup>1</sup> after program participation. Having a diversified asset base is also important for resilience,

<sup>1</sup> Farmers self-reported the quantity of assets they own and we apply an average value of each asset to determine the value of assets owned by the farmer.

and we note that treatment farmers in all countries, except for Tanzania, see an impact for asset diversification.

We only find impact on school attendance<sup>2</sup> for children in our client households in Rwanda. This is possibly attributed to comparatively low baseline attendance in that country and that there was room for impact there. For example, school attendance in Kenya was already 92% compared to 63% in Rwanda. Veteran One Acre Fund farmers in Kenya and Tanzania were more likely to be healthier<sup>3</sup> and in Rwanda, they were more likely to invest in treatment for sick HH members compared to controls. We find impact on income diversity in Burundi and Uganda where income diversity for controls was comparatively very low and perhaps there is much scope for increase in this regard.

We did not expect to find high program impact on social networks<sup>4</sup> since the pathways for influence were expected to be longer. Surprisingly, in Rwanda and Burundi, where we would have hypothesized that social cohesion is comparatively lower overall than other countries, we notice high program impact on all social network indicators. We also find some impact on farmer networks in Malawi and Tanzania where we compared veteran One Acre Fund farmers with newly enrolled farmers.

**Measuring Experienced Resilience:** The resilience capacity index can make predictive estimates of how well a farmer will react if a shock does occur to them. However, we are also keen to understand how farmers have already reacted to shocks that may have taken place in the past. We measure experienced resilience through two different areas: coping strategies used and bouncing back after a shock. First, we study coping strategies used by households if they faced a shock to see which strategies implied more resilience. For example, if a farmer used savings it would be considered a stronger coping strategy than if they had to sell off livestock. Secondly, we ask farmers to self-assess how well they bounced back after the shock.

Our approach to measuring experienced resilience is perhaps not as robust as the resilience capacity index. The reasons are threefold: First, the sample sizes reduce drastically when we only look at farmers who have faced a shock which reduces our ability to detect any impact, if it exists. Secondly, the responses provided here are subjective to how a farmer defines a shock in the first place and their self-assessment on their recovery after the shock. Thirdly, moving the needle on actual resilient outcomes that are detectable can take several years. We do not find any statistically significant difference between our treatment and control groups on any of the experienced resilience scores. This may be due to the three limitations outlined above.

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<sup>2</sup> School attendance calculated as % of school-age children (under 18 years of age) in household who are attending school.

<sup>3</sup> Health measured by self-reported measure of % of household members sick in last week and % of sick household members who sought treatment.

<sup>4</sup> Social networks measured by proxy indicators such as participation in savings schemes and likelihood of being able to borrow 5 kg of maize and equivalent of \$50 from neighbors.

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## INTRODUCTION

This document outlines the methodology used by One Acre Fund to measure the program's impact on farmer resilience and also presents the results from the study conducted in 2017 across six countries. One Acre Fund continually measures [dollar impact](#) of our clients each year by looking comparing farm output (as measured through physical harvests) and input costs and by comparing One Acre Fund farmers to similarly situated neighbors. However, over time, we have [expanded our concept of impact](#) to move beyond immediate farmer profit to other areas that are not easily monetized but entail meaningful changes in farmers' lives. One such area is the measurement of farmer resilience.

One Acre Fund's target population lives an existence close to the margins, and our program intends to help bring these farmers into a more stable and prosperous existence. Building our clients' resilience – their capacity to withstand shocks and stressors – is essential to ensuring the sustainability of program impact. This study is an attempt to understand One Acre Fund's impact on farmer resilience across all countries where we operate.

### Defining Resilience and Shocks

There are several definitions of resilience in the literature. Within the One Acre Fund context, we can define a resilient smallholder farmer as one who can continue to provide a quality life for themselves and their family after facing a shock that reduces their household income substantially. The definition provided by the Food Security Information Network resonates with the objectives of this study.

***“Resilience is the capacity that ensures adverse stressors and shocks do not have long-lasting adverse development consequences”***

*(Resilience Measurement Technical Working Group of the Food Security Information Network, 2014)*

Resilience comes into play only once a shock, such as an illness of a primary household earner or a seasonal drought, has occurred. At One Acre Fund, we work to eliminate hunger and build pathways to prosperity for smallholder farmers. So although we work in agriculture, our main focus is actually farmer prosperity. For the purposes of understanding shocks faced by farmers, we look beyond agricultural shocks to incorporate disruptions in farmers daily lives, for example, thefts, breakup of the household, natural hazards, business loss etc. For measurement purposes, we define **shocks as any disruption that reduces a farmer's household income by a 25% or more.**

### Principles for Resilience Measurement

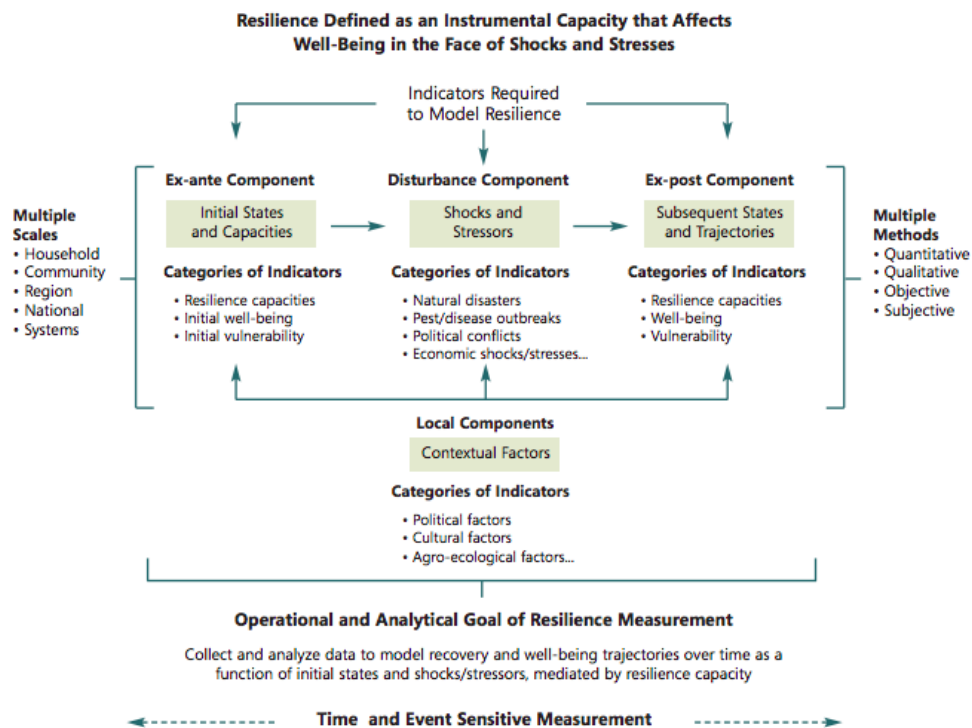
We recognize that resilience can have different meanings across different contexts, income levels and program interventions. Thus, to better understand how to operationalize the concept, we undertook a landscape analysis of measurement approaches employed by similar organizations and assessing their fit with our clients and current data collection capabilities.

Upon completing this analysis, we borrowed key elements from a few existing models and created a

resilience approach that is **appropriate for the One Acre Fund context** and measurable into a **single “resilience score”**. We also wanted the resilience measurement to **enable programmatic learning** so we devised a method that would allow us to unpack the different drivers of resilience.

The Food Security Information Network (FSIN) Resilience Measurement Technical Working Group created a common analytical model ([Constas et al., 2014](#)) with indicators based on when the resilience measurement is taking place: (1) ex-ante, (2) disturbance or (3) ex-post. Measurement of ex-ante resilience makes predictive estimates of resilience and can comprise of multi-dimensional indicators capturing resources, relationships, and skills held by the unit of analysis before a shock takes place. The disturbance component is concerned with the intensity of a shock and stressor. Finally, the ex-post components are related to resilience capacity, vulnerability and development outcomes after a shock has taken place.

**Figure: FSIN Common Resilience Analytical Model**



(Source: [Constas et al., 2014](#), p.14)

An example of ex-ante resilience measurement is the [Resilience Index Measurement and Analysis \(RIMA\)](#) tool created by the Food and Agriculture Organization (FAO). The tool estimates resilience through a set of multidimensional pillars, which are then aggregated through latent variable models. The RIMA pillars include access to basic services, assets, social safety nets, sensitivity, and adaptive capacity.

Outside of the common analytical framework, some measure the costs of resilience in order to quantify



it. [Bene \(2013\)](#), put forward a model to measure resilience by quantifying the costs of passing through a shock or stressor. The author suggests that the “costs of resilience” can be explained by “*the different ex-ante and ex-post investments, losses, sacrifices, and costs that people have to undertake at individual and collective levels to ‘go through’ a shock or an adverse event*”. Essentially, a more resilient person will have a lower resilience cost than a less resilient person. We eventually did not consider this model for our resilience measurement purposes due to incompatibility with existing data collection at One Acre Fund.

Finally, we modeled our main measurement strategy to measure ex-ante resiliency, or resilience capacity loosely along the lines of the FAO RIMA II model (mentioned above) which estimates resilience through a set of pillars that act as proxies for resilience. Apart from operational feasibility, the RIMA model was also found to be relevant because it factors in indicators such as agricultural knowledge and diversity of agricultural systems to measure resilience of smallholder farmers. However, we depart from the RIMA II model in terms of some indicators used to quantify resilience as well as the methodology to calculate the resilience score to adjust for our context and grounded in the realities of the smallholder farmers that we serve.

To ensure that we don’t just rely on how resilience has been defined by others in the field but also tailor our measurement to exactly how farmers define and prioritize resilience for themselves, we conducted additional qualitative research with smallholder farmers on the topic of resilience. In September 2016, we undertook 18 different focus groups discussions with farmers (One Acre Fund and non-One Acre Fund) living in geographies that we operate in Rwanda and Tanzania. The focus groups were spread across different geographies to obtain a rich sample of farmers who represent different experiences due to their climatic and income differences. The discussions were to better understand the typical shocks farmers face and their coping mechanisms to survive such shocks. The focus groups also touched on ideal coping mechanisms that participants could have undertaken (but not necessarily have done so). The results from the qualitative analysis informed a large part of our resilience measurement methodology in terms of the indicators we use and degree of importance given to each indicator in the resilience capacity measurement.

## **THE RESILIENCE CAPACITY INDEX: BUILDING BLOCKS AND MEASUREMENT**

As detailed in the sections above, resilience can be understood as a certain ability or capacity of an individual or a household and is difficult to be observed and measured directly. However, we can measure resilience indirectly by looking at current assets, livelihood strategies and general way of life maintained which can provide signs on how the household will react and cope in the event of an income shock.

### **Resilience Capacity Pillars**

For our main strategy we measure resilience through a set of proxy indicators. Overall, we have identified five key pillars that predict the farmers resilience that we are keen to measure. These are: food access, assets owned, good agriculture practice, adaptive capacity and social networks. Each pillar is composed of around 2-4 indicators and there are 14 indicators in total that feed into the resilience index. Below we

shed some light on each of the five pillars. For a complete list of the indicators in the Resilience index, please refer to Annex B.

**Figure: One Acre Fund Resilience Capacity Pillars**



**Food Access:** This pillar measures that if a financial shock were to happen, to what extent a household would be able to feed themselves with existing grains from crops grown on their farm in the previous season without relying on other means. The indicators specifically measure whether the household has any grain left and the amount of grain left during the hunger season.

**Assets Owned:** When a household faces an income shock, they can choose to reduce their consumption to adjust to the new realities. Another option for them is to use their prior accumulated asset base to smooth consumption during the shock period. Given that we are concerned with smallholder farming households whose consumption patterns are mostly limited to the bare necessities, a substantial decrease in their consumption could lead to negative consequences on health or quality of life. Alternatively, savings or assets accumulated before the shock could be sold or traded to smooth or limit decrease in consumption.

Under this pillar, we measure the household’s current levels of savings as well as the value of their physical and livestock assets that can be traded (self-reported by the farmers). Having a diversified set of assets can typically be useful since the household can choose from a larger variety of assets to sell. Therefore we also add an indicator that captures diversification of assets (the share of physical and livestock assets owned from the entire list that we are counting from).

**Agriculture Practice and Technology:** Here we measure if the farmer is using practices that can insulate their farm income, to the extent possible, from agricultural shocks. We use two types of indicators under this pillar. The first is related to using good agricultural practices that we have found to drive higher yields (for the primary crop, maize, grown by the farmers in the season we measure this data). These practices could range from using correct row and plant spacing, correct amount of fertilizer, correct seed depth, applying fertilizer correctly, etc. Each set of planting practices being used for the indicator are tailored to each country based on what practices we found to be most effective from our core program.

The second indicator used is a crop diversity index. Having a diverse set of crops grown insulates farmers from shocks that target one particular crop (e.g. a maize pest), reduce over-reliance on a single (or few) crops and also contribute to a more nutritious diet for the household if they consume the crops grown. We use the Simpson's index to measure crop diversity. This index provides weights for "richness", where a higher weight is given for number of crops grown and "evenness", where a higher weight is given or a more flat distribution and lower weight for when there is concentration on just a few crops. The final variable is between 0 and 1 where 1 represents highest crop diversity and 0 when no crops are grown.

Adaptive Capacity: Adaptive capacity represents the household's ability to adapt to the changing environment in which it operates (FAO RIMA 2016). Resilience capacity relies not only being able to absorb a shock but also being able to redistribute coping strategies with the changing environment. In other words resilience can be thought of both, strength and flexibility. While strength can refer to existing assets and networks, adaptive capacity refers to the flexibility.

A variety of factors determine adaptive capacity. For the sake of our measurement, we focus on the areas on which One Acre Fund can realistically have any impact. Having educated children can improve the prosperity of the family in the future, a healthier family will be able to better adapt and bounce back after a shock, and income diversity opens up options for the household when a shock disturbs one specific income stream. Under this pillar, we identify education of school going children in the household, health outcomes for the entire household, and income diversity as key determinants of adaptive capacity.

Social Networks: Support from family and friends can be crucial in times of need by either emotionally supporting, or contributing to the household either through monetary or in kind support. Borrowing money from family and friends is a recourse many focus group participants reported to have undertaken to smooth their cash flows after facing shocks or income deficits. Therefore, we assume a household with larger and deeper networks will have more resilience capacity as they can 'fall back' on their network's support if needed.

There are a several novel methods to measure networks in the literature. These range from using self-reported data provided by the respondent on their social networks to using more objective indicators that act as proxy indicators for social networks or even running an experiment within a sample where individuals are matched with each other to judge their network strength (Mekonnen, Daniel Ayalew, Gerber, Nicolas and Matz, Julia Anna (2016)).

One measure that we found to be most relevant to our context is a paper by [Reed and Courtney \(2013\)](#). This paper sets out to measure social capital for farmers across three dimensions; bonding, bridging and linking. For our purposes, we focused on their measurement of "Bonding" which refers to bonds within groups or families that are horizontal ties between peers. Such bonds are generally assumed to be strong and frequent. The higher the degree of bonding, the higher probability of receiving support during stressful times. Reed and Courtney (2013) found that having a responsibility within farming groups was the strongest proxy variable for bonding ties. Apart from this, getting favors from farming neighbors was

also one of the several indicators that were found to be proxy for ‘bonding’. We adapted these indicators and included indicators for being part of ROSCA/Merry Go Round saving Groups, and whether the respondent could rely on someone for borrowing a 5 kg bag of maize and additionally borrowing equivalent to \$50 for measuring farmer social networks.

### **Calculating the Final Resilience Capacity Score**

To make sure all 14 indicators in the model have comparable scales, we compute the average standardized effects for each variable where the indicator is not already a binary variable. We then divide each variable by its standard deviation (Kling, Liebman, and Katz 2007). Finally, each indicator in the model takes a value between 0 and 1. All indicators are not assumed equal – weights have been assigned to each indicator for their assumed importance to resilience, based on results of our focus group discussions and literature reviews. The final resilience capacity score is a weighted average of all 14 indicators and is also between 0-1. By using a single resilience capacity score, we are able to conduct a single hypothesis test to measure our impact on farmers’ resilience relative to comparison farmers.

### **Final Analysis and Defining the Treatment and Control Groups**

We use veteran One Acre Fund farmers as our program group in all countries where this study took place. A veteran farmers is defined as someone who has at least gone through one year of program participation. The control group selection, however, varies across countries.

In Kenya, Tanzania, Uganda and Malawi we use new One Acre Fund farmers as the counterfactual group. New One Acre Fund farmers are those that have enrolled into the program for the first time but have not yet reaped the benefits of the program (data is collected before they harvest). Since these farmers have self-selected into the program, we believe them to be a highly comparable group to the veteran One Acre Fund farmers.

In Burundi and Rwanda, however, the program is saturated within the older areas of operation. New One Acre Fund farmers are more likely to come primarily from newer areas where the program has expanded. Therefore, new One Acre Fund farmers would not be as comparable to veteran farmers given geographic differences. Instead, in these two countries we use randomly selected non One Acre Fund farmers who are living in the same geography as veteran One Acre Fund farmers but have never enrolled into the program. To control for the selection bias, we use propensity score matching to help minimize any differences between the control group and the treatment group.

The final analysis looks at the average resilience capacity score between the veteran One Acre Fund farmers and the counterfactual group. Although we would have preferred to use a consistent methodology across all the countries where we conducted this study, we had to change the method of analysis based on the counterfactual group being used (due to the constraints listed above). For most One Acre Fund countries, we use regression analysis controlling for location effects to understand the difference in average resilience score of the One Acre Fund farmers compared to new One Acre Fund farmers. In Rwanda and Burundi (where non One Acre Fund farmers are the counterfactual group), we

use propensity score matching to control for any observable differences between the program and control groups.

Countries	Treatment Group	Counterfactual Group	Methodology
Kenya Tanzania Uganda Malawi	Veteran One Acre Fund Farmers (Participated in One Acre Fund program for at least season)	New One Acre Fund Farmers (Have not yet seen any program impact)	Regression controlling for location effects
Burundi Rwanda	Veteran One Acre Fund Farmers (Participated in One Acre Fund program for at least season)	Non One Acre Fund farmers (Never enrolled in program and One Acre Fund farmer neighbors)	Propensity Score Matching

## DATA COLLECTION

Income and expenditure for smallholder farmers is usually “lumpy” and varies to a significant degree depending on the season. Since we are measuring resilience, it is important that we conduct the survey when the community is most vulnerable and may already have faced some shocks. Therefore, we collected data during the hunger season (before the harvest) which provided the best opportunity to capture differences in income and hunger.

The Monitoring and Evaluation team at One Acre Fund regularly collects comprehensive data related to farming and quality of life from a representative group of One Acre Fund and control farmers. So, many of the data points required for this study were already covered in the existing M&E Impact Surveys. However, the remaining indicators that were not yet covered in current efforts were appended to the regular input costs survey conducted in all our core countries. These input costs surveys are typically conducted after the farmers have planted their maize and just before they harvest. In some cases, due to the increased length of the survey, we conducted the data separately from this survey, but also during the hunger season.

**Table: Sample Sizes for Resilience Study across Countries**

Country	Treatment (Veteran One Acre Fund)	Counterfactual Group (New One Acre Fund or Non One Acre Fund farmers)
Burundi	643	949
Rwanda	1362	1362
Kenya	1588	594
Tanzania	527	301
Uganda	125	438
Malawi	151	315

## RESILIENCE CAPACITY FINDINGS

For this study, we have reported differences that are statistically significant at  $p < .05$ . This means there is less than a 5% chance that these differences would be caused by chance.

**Resilience Score:** We find a statistically significant impact on the total resilience score for veteran One Acre Fund farmers in all countries of operation where we conducted this study. One Acre Fund impact on resilience capacity (as measured) is between 0.02 - 0.06, which can also be understood as an increase in resilience capacity by 2% pts. - 6% pts.

Country	Rwanda		Burundi		Kenya		Tanzania		Uganda		Malawi	
Group	One Acre Fund	Non One Acre Fund	One Acre Fund	Non One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund	One Acre Fund	New One Acre Fund
Average Scores	0.46	0.42	0.37	0.32	0.43	0.4	0.4	0.36	0.42	0.36	0.47	0.45
One Acre Fund Impact	0.04		0.05		0.03		0.04		0.06		0.02	

We do however, find divergence in the sub-indicators that contribute to the increased resilience capacity across countries. The heat map below shows a quick overview of the varying degrees of impact noticed across the pillars. For detailed results on the outcomes for each indicator, please refer to Annex C at the end of this document.

**Table: Heat Map of Impact on Resilience Pillars Across One Acre Fund Countries (Ordered by program size)**

	Food Access	Assets Owned	Agricultural Practice	Crop Diversity	Adaptive Capacity	Social Networks
Kenya	Dark Green	Light Green	Dark Green	Dark Green	Light Green	Light Green
Rwanda	Light Green	Dark Green	Dark Green	Dark Green	Light Green	Dark Green
Burundi	Dark Green	Dark Green	Dark Green	Dark Green	Light Green	Dark Green
Tanzania	Light Green	Light Green	Dark Green	Grey	Light Green	Light Green
Uganda	Light Green	Dark Green	Dark Green	Grey	Light Green	Grey
Malawi	Grey	Light Green	Light Green	Grey	Light Green	Light Green

Impact on most indicators	No impact
Impact on some indicators	Data not collected

**Food Access:** As expected, we find significant program impact on food access in most countries of operation, which is the first link in the One Acre Fund theory of change (see Annex A). Barring Malawi, which has had challenges with both floods and droughts, clients in all other countries were more likely to either have harvest remaining or feeding themselves from their harvest during the hunger season. In Kenya and Burundi, veteran One Acre Fund farmers were also more likely to have more harvest per acre left from the previous season. Please see Annex A for a detailed graph of the One Acre Fund Theory of Chang

**Assets Owned:** We find statistically significant impact on farmland owned in Rwanda, Burundi and Uganda. One Acre Fund farmers in Rwanda, Tanzania and Uganda also accumulated more value of tradable assets after program participation. Having a diversified asset base is also important for resilience, and we note that clients in all countries, except for Tanzania, see an impact on asset diversification. We find no impact in any of the countries on self-reported financial savings. The lack of savings despite having a harvest improvement might be due to farmer preference for investing in livestock or education. It also might be difficult to detect an impact in this area due to well documented difficulties in getting accurate self-reported data on household cash savings.

**Agricultural Practice:** We identified key agricultural practices that were found to drive higher yield tailored to each country and compared veteran One Acre Fund farmers to non-One Acre Fund farmers. We expected to see high impact in this pillar given the program’s strong focus on improving planting practices for enrolled farmers. Therefore, it is not surprising that in established program countries (Kenya, Rwanda, Burundi and Tanzania), veteran One Acre Fund clients were more likely to follow the context specific planting practices than non-One Acre Fund farmers. In our newer country Malawi, we were unable to collect planting practices data from the same cohort of farmers as the resilience study.

**Crop Diversity:** We find impact on crop diversity for veteran One Acre Fund farmers in Kenya, Burundi and Rwanda. In general, crop diversity seems to be very high in Burundi and Rwanda - where we know that farmers naturally grow a variety of crops. One Acre Fund program participation seems to have contributed to even more increased crop diversity in these two countries. Comparatively, farmers in Kenya and Tanzania score very low in terms of crop diversity – possibly because of their higher dependence on maize. However, One Acre Fund involvement seems to be moving clients towards crop diversity in Kenya. In newer countries, Uganda and Malawi, we were unable to collect detailed land sizes dedicated to non-maize crops. Given lack of data we instead measure crop diversity in terms of growing three or more crops. We find no impact in either Uganda or Malawi for this variable

**Adaptive Capacity:** Under adaptive capacity, we measure areas which enable a household to adapt themselves easily to cope with the changing environment in the event of a shock. We find that there is no global set path of how farm profit translates into adaptive capacity, i.e. country context matters for which

indicator One Acre Fund farmers will choose to invest in their adaptive capacity.

- **Education:** We only find impact on school attendance for children in our client households in Rwanda. This is possibly because baseline attendance was low in the country and there was room for impact there compared to other mature One Acre Fund countries. For example, education attendance in Kenya was already 92% compared to 62.9% in Rwanda.
- **Health:** Veteran One Acre Fund farmers in Kenya and Tanzania were more likely to be healthier and veteran One Acre Fund farmers in Rwanda were more likely to have higher spending for health treatment due to program participation. We find no impact on health outcomes in Burundi and the new One Acre Fund program countries, Uganda and Malawi.
- **Income Diversity:** We notice impact on income diversity in 2 countries: Burundi and Uganda. This is possibly because income diversity was very low in these countries and there is much scope for diversification. Whereas in most of the remaining countries, baseline income diversification was comparatively higher.

**Social Networks:** We measure social networks through proxy indicators for farmer networks. We expected to see low program impact on this pillar since the pathways for influence are expected to be longer. In Rwanda and Burundi, we find high program impact on all social network indicators. We also see some impact on farmer networks in Malawi where we compared veteran One Acre Fund farmers with newly enrolled farmers. This is suggestive that program participation also strengthens social networks for farmers.

## OTHER DIRECT MEASURES OF RESILIENCE: EXPERIENCED RESILIENCE

The resilience capacity index can make predictive estimates of how well a farmer will react if a shock does occur to them. However, we are also keen to understand how farmers have already reacted in shocks that may have taken place in the past. To do so, we look into farmer's self-reported experiences after having faced a shock. We measure experienced resilience looking at two different areas: coping strategies used and bouncing back after a shock.

### Coping strategies used in the case of a shock

Here, we look at actual experiences of coping with a shock and if the household used coping strategies that exhibit resilient qualities. We assign scores to actual coping strategies used by the respondents in the event faced during a shock. Strategies that are proactive in nature, do not entail reduction in income/livelihoods and do not harm health – for example using savings, or selling tradable assets – receive a higher score. Strategies that have more negative consequences, such as cutting food consumption, receive a lower score. The highest score that a shock-facing household can receive under this component is 7 and the lowest is 1. See table 2 below for a breakdown of the criteria used for scoring coping strategies.

The respondent can choose to provide multiple responses on the survey if more than one coping strategy was used to cope with a specific shock. In the case of multiple strategies used, the coping strategy used that has the lowest score is assigned to the household.



**Table: Criteria for Scoring Coping Strategies Used**

Characteristics of Coping Strategies Used	Highest - Score 7	Score 5	Score 3	Lowest-Score 1
Has a proactive response to anticipate and adjust to the shock				
Does not have a negative impact on health				
Does not entail reduction income/livelihood/lifestyle in the future				
Examples	Using savings	Selling assets, Borrowing money	Cutting food consumption	Foraging

### Bouncing Back after a Shock

We also look at how well the farmers fared after experiencing an actual shock. As with the coping strategies score, we focus only on respondents who have reported facing any shock at all. We provide a high score to those who score a positive return to normalcy, and a low score to those who could not return to normalcy.

There are certain limitations to this particular component. First, this data will be self-reported and each respondent may have different perceptions of what constitutes “bouncing back” or “returning to normalcy”. However, we assume this limitation to be the same for control and One Acre Fund farmers. The second limitation is that it does not distinguish responses based on the severity of a shock. For example, returning to normalcy after facing a shock which reduced income by, say, 70% will be different to a shock that reduce income by 30%, but we do not distinguish between the severity of the shock in this study.

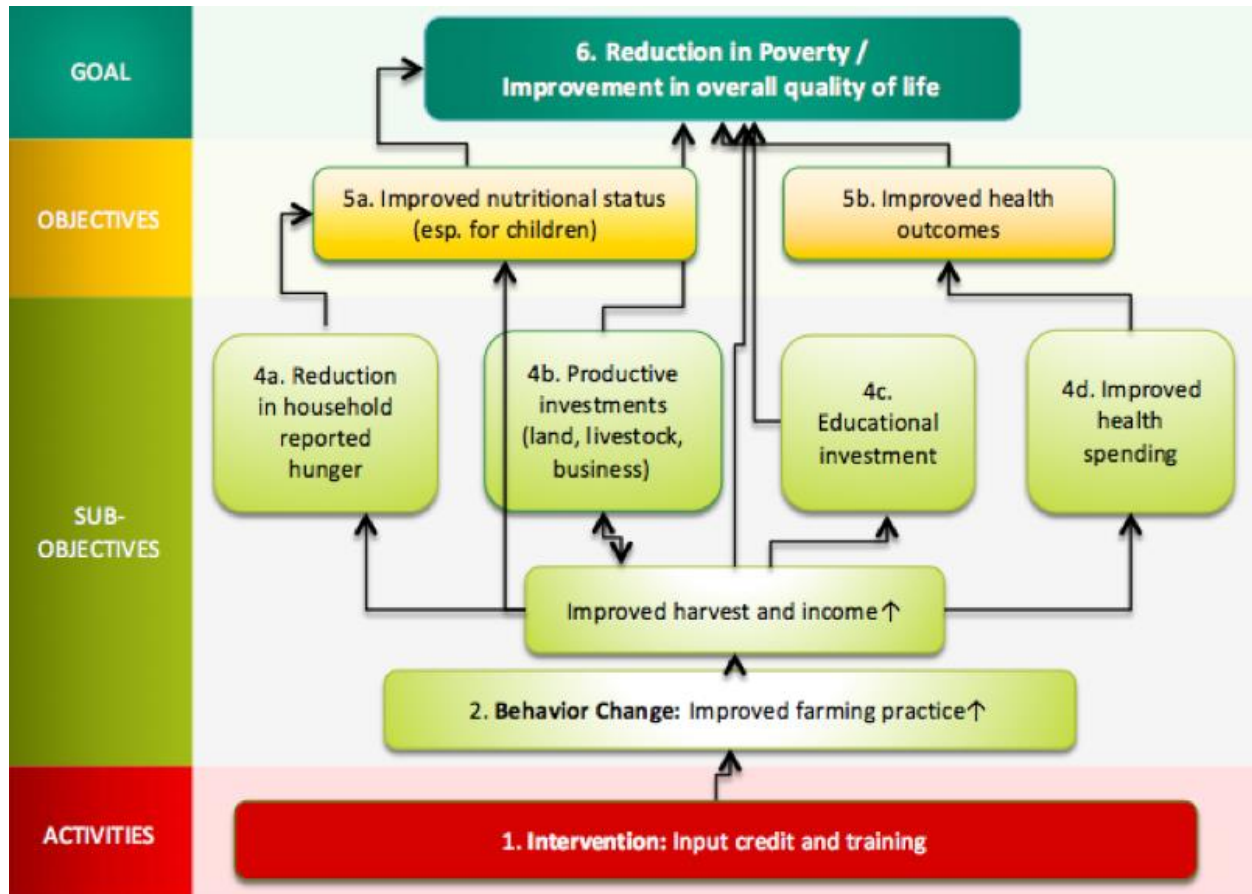
### Experienced Resilience Findings

Our approach to measuring experienced resilience is perhaps not as robust as the resilience capacity index. The reasons are threefold: First, the sample sizes reduce drastically when we only look at farmers who have faced a shock which reduces our ability to detect any impact, if it exists. Secondly, the responses provided here are subjective to how a farmer defines a shock in the first place and their self- assessment on their recovery after the shock. Thirdly, moving the needle on actual resilient outcomes that are

detectable can take several years. We do not find any statistically significant difference between our treatment and control groups on any of the experienced resilience scores.

**ANNEXES**

**Annex A: One Acre Fund Theory of Change**



## Annex B: Indicators feeding into the Resilience Capacity Index

PILLAR	PILLAR SCORE	INDICATORS
Income and Food Access	5	Whether household is eating food from harvest during hunger season
		# Kg of staple grain per acre available from harvest during hunger season
Assets Owned	9	Farm land owned
		Total value of tradable assets
		Diversification of assets (total assets owned/total possible owned as per survey)
		Savings/Financial assets owned
Agricultural Practice and Diversity	5	Score for using most effective planting practices in respective country (Number of practices being followed/Total Number of Good Practices Measured)
		Crop Diversification Variable
Adaptive Capacity	7	% Of school-age children in HH who are attending school
		Health Indicator (Half: % of HH members sick in last week, Half: % of sick HH family members who sought treatment).
		If HH has more than 2 income sources
Social Networks	3	Whether farmer is part of ROSCA/Merry go round/ Savings Groups
		Whether respondent can rely on someone to borrow a small bag of maize (5 kg)?
		Whether respondent can rely on someone to borrow \$50

## Annex C: Detailed Results for Resilience Capacity Index

### 1. Detailed Findings for Rwanda, Burundi and Kenya

No.	Indicator	Rwanda			Burundi			Kenya		
		Non 1AF	Veteran 1AF (2 or more seasons)	P> z	Non 1AF	Veteran 1AF	P> z	New 1AF	Veteran 1AF	P> t
	<b>Resilience Capacity Score (0-1)</b>	<b>0.42</b>	<b>0.46</b>	<b>0.00</b>	<b>0.32</b>	<b>0.365</b>	<b>0.00</b>	<b>0.40</b>	<b>0.44</b>	<b>0.00</b>
<b>FOOD ACCESS</b>										
1.1.	% households who have grains from harvest left during hunger season/ eating food from their harvest	72.3%	78.5%	0.01	31.5%	37.6%	0.055	41.9%	56.5%	0.00
1.2.	Average # kg of staple grain per acre available from harvest during hunger season	0.88	1.11	0.42	23.18	28.7	0.097	74.3	123.0	0.00
<b>ASSETS OWNED</b>										
2.1.	Farm land owned (in acres)	0.72	1.1	0.00	0.919	1.048	0.02	1.91	1.80	0.12
2.2.	Total value of tradable assets (in USD)	466.0	698.8	0.03	303.9	309.9	0.86	1,439.7	1,501.9	0.50
2.3.	Diversification of assets (total assets owned/total possible owned as per survey)	18.8%	23.1%	0.00	26.9%	31.5%	0.00	43.3%	47.2%	0.00
2.4.	Savings/Financial assets owned (in USD)	147.8	204.5	0.35	-	-	-	94.8	81.2	0.14
<b>AGRICULTURAL PRACTICE AND TECHNOLOGY (Compared to Control farmers in all countries)</b>										
3.1.a	% Complying to Planting in Line	52.5%	72.1%	0.00	1.2%	27.9%	0.00	--	--	--
3.1.b	% Complying to: Correct Row Space	--	--	--	--	--	--	--	--	--
3.1.c	% Complying to: Correct Plant Space	--	--	--	--	--	--	30.0%	92.1%	0.00
3.1.d	% Complying to: Applied Fertilizer	--	--	--	--	--	--	84.7%	98.8%	0.00
3.1.e	% Complying to: Applied Fertilizer Correctly	--	--	--	43.6%	84.2%	0.00	--	--	--
3.1.f	% Complying to: Using Correct Amount of Fertilizer	8.5%	18.9%	0.00	4.1%	41.6%	0.00	--	--	--
3.1.g	% Complying to: Using Sufficient Compost	25.2%	31.7%	0.02	79.5%	83.0%	0.19	--	--	--
3.1.h	% Complying to: Used Correct Type of Fertilizer	--	--	--	--	--	--	94.0%	100%	0.00
3.1.i	% Complying to: Use Hybrid Seed	--	--	--	--	--	--	72.8%	97.2%	0.00
3.1.j	% Complying to: Correct Seed Depth	--	--	--	--	--	--	1.9%	29.1%	0.00
3.2.	Crop Diversification Variable	0.489	0.518	0.02	0.68	0.71	0.01	0.241	0.268	0.02
<b>ADAPTIVE CAPACITY</b>										
4.1.	% of school-age children in household who are attending school	62.9%	69.3%	0.00	66.4%	64.6%	0.44	91.6%	91.6%	0.95
4.2.a	% of HH members healthy in last week	71.7%	70.1%	0.29	69.1%	69.8%	0.58	41.4%	46.2%	0.01
4.2.b	% of sick HH family members who sought treatment	88.5%	92.6%	0.01	27.5%	32.8%	0.09	96.4%	96.6%	0.85
4.3.	% HH's that have more than 2 income sources	56.9%	55.8%	0.70	26.8%	35.1%	0.01	73.2%	75.8%	0.23
<b>SOCIAL SECURITY</b>										
5.1.	% respondents that are part of ROSCA/Merry go round/ Savings Groups	52.8%	72.8%	0.00	10.0%	13.0%	0.16	67.4%	75.7%	0.00
5.2.	% respondent that can rely on someone to borrow a small bag of maize (5 kg)?	39.7%	51.7%	0.00	9.9%	17.5%	0.00	64.1%	65.0%	0.71
5.3	% respondent that can rely on someone to borrow \$50	19.3%	34.6%	0.00	32.0%	36.5%	0.00	43.9%	45.3%	0.56

## 2. Detailed Findings for Tanzania, Uganda and Malawi

No.	Indicator	Tanzania			Uganda			Malawi		
		New 1AF	Veteran 1AF	P> t	New 1AF	Veteran 1AF	P> t	New 1AF	Veteran 1AF	P> t
	<b>Resilience Capacity Score (0-1)</b>	<b>0.36</b>	<b>0.4</b>	<b>0.000</b>	<b>0.36</b>	<b>0.42</b>	<b>0.000</b>	<b>0.45</b>	<b>0.47</b>	<b>0.10</b>
<b>FOOD ACCESS</b>										
1.1.	% households who have grains from harvest left during hunger season/ eating food from their harvest	48.3%	64.4%	0.000	8.9%	17.3%	0.01	13.5%	15.6%	0.57
1.2.	Average # kg of staple grain per acre available from harvest during hunger season	171.5	188.7	0.414	24.37	32.83	0.49	16.0	15.1	0.86
<b>ASSETS OWNED</b>										
2.1.	Farm land owned (in acres)	2.8	3.2	0.14	2.82	3.56	0.03	1.83	1.79	0.65
2.2.	Total value of tradable assets (in USD)	933	1676	0.02	1374.3	1778.9	0.05	871.2	857.5	0.95
2.3.	Diversification of assets (total assets owned/total possible owned as per survey)	41.9%	42.9%	0.31	29.7%	35.2%	0.00	23.5%	25.8%	0.05
2.4.	Savings/Financial assets owned (in USD)	28.50	23.90	0.72	31.09	24.44	0.86	33.4	38.2	0.85
<b>AGRICULTURAL PRACTICE AND TECHNOLOGY (Compared to Control farmers in all countries)</b>										
3.1.a	% Complying to Planting in Line	--	--	--	--	--	--	--	--	--
3.1.b	% Complying to: Correct Row Space	46.5%	39.1%	0.18	--	--	--	--	--	--
3.1.c	% Complying to: Correct Plant Space	33.2%	23.8%	0.06	--	--	--	--	--	--
3.1.d	% Complying to: Applied Fertilizer	99.4%	100.0%	0.04	0.9%	98.1%	0.00	--	--	--
3.1.e	% Complying to: Applied Fertilizer Correctly	44.5%	35.6%	0.06	2.7%	81.5%	0.00	--	--	--
3.1.f	% Complying to: Using Correct Amount of Fertilizer	17.8%	30.6%	0.00	--	--	--	--	--	--
3.1.g	% Complying to: Using Sufficient Compost	--	--	--	--	--	--	--	--	--
3.1.h	% Complying to: Used Correct Type of Fertilizer	--	--	--	--	--	--	--	--	--
3.1.i	% Complying to: Use Hybrid Seed	--	--	--	--	--	--	--	--	--
3.1.j	% Complying to: Correct Seed Depth	--	--	--	--	--	--	--	--	--
3.2.	Crop Diversification Variable	0.18	0.2	0.28	--	--	--	0.90	0.91	0.71
<b>ADAPTIVE CAPACITY</b>										
4.1.	% of school-age children in household who are attending school	73.60%	76.40%	0.459	63.39%	77.64%	0.25	89.1%	89.4%	0.88
4.2.a	% of HH members healthy in last week	69.26%	59.44%	0.083	78.30%	77.97%	0.92	71.2%	68.2%	0.28
4.2.b	% of sick HH family members who sought treatment	97.87%	98.16%	0.876	99.72%	100.00%	0.48	97.9%	99.0%	0.37
4.3.	% HH's that have more than 2 income sources	26.60%	27%	0.931	21.54%	30.13%	0.05	50.4%	53.9%	0.50
<b>SOCIAL SECURITY</b>										
5.1.	% respondents that are part of ROSCA/Merry go round/ Savings Groups	22.56%	30.76%	0.03	63.09%	66.97%	0.45	43.4%	49.1%	0.25
5.2.	% respondent that can rely on someone to borrow a small bag of maize (5 kg)?	31.81%	29.84%	0.62	46.90%	52.48%	0.36	56.6%	68.0%	0.03
5.3	% respondent that can rely on someone to borrow \$50	28.90%	29.03%	0.97	30.70%	35.36%	0.35	23.4%	29.9%	0.14