Extended Abstract
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Paper/Poster Title	Vulnerability to resilience for smallholder small grain farmers in Southern Zimbabwe

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Abstract	***200 words max***
The purpose of this study was to determine the levels of smallholder small grain farmers' resilience in the four districts (Binga, Chiredzi, Hwange, Matobo) of Zimbabwe. Data was collected in four districts purposely selected from semi-arid regions using a structured questionnaire. A mixed method approach was used to collect data from 281 respondents who were randomly selected from four districts. A multistage sampling approach with purposive selection of districts dominant in small grain production was conducted. For each district, two wards were selected randomly. Stata version (16) was used to analyse data. Factor analysis and Agricultural drought index (ADRI) were used to quantify farmer vulnerability and resilience. Results show that 46.3% of the sample were in the medium vulnerability group while 26% were highly vulnerable. Districts on contract farming were less vulnerable than districts on non-contract. Farmer resilience varied with location with Chiredzi having highest (ADRI 4.56) and the least was Matobo (ADRI 3.32). We recommend that farmers in regions IV and V embrace the production of improved small grain varieties and conservation agriculture as an adaptation strategy to climate change. Agricultural policies relating to the production of small grain on contract farming must be enforced leading to farmer resilience.	

Keywords	climate change, small grain, adaptation strategy, vulnerability and resilience.
JEL Code	Q 0 General Q1 Agriculture Q2 Renewable Resources Conservation Q5 Environmental economics see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***

Climate change poses a significant threat to smallholder farmers and threatens to undermine community progress towards poverty alleviation, food security and sustainable development. Smallholder farmers are highly vulnerable to climate change because most depend on rain-fed agriculture, cultivate marginal areas and lack access to information and financial support that could help them invest in more climate-resilient agriculture. Understanding the impacts of climate change on smallholder farmers and developing appropriate adaptation strategies are critical, where small-scale agriculture is central to economic development, food security and resilience. Globally, agriculture remains the mainstay of economic activity and a key issue for sustainable livelihoods. In Zimbabwe, the majority of the population lives in rural areas where livelihoods are hinged on agriculture. The need to graduate small grain farmers from

vulnerability to resilience through climate variability coping mechanisms against shocks and stresses cannot be over emphasized. In this paper we argue that small grain production takes away the guess work by providing a better strategy to hedge against climate change shocks and stresses in districts affected by climate change. Regardless of evidence supporting our argument, high levels of vulnerability to smallholder farmers in some regions are of great concern. This paper provides a glimpse of this problem using data collected from four districts (Binga, Chiredzi, Hwange and Matobo) in Zimbabwe's agro-ecological regions 1V and V. The paper unfolds in six parts as follows; background of the study, guiding conceptual and theoretical frameworks, literature review, methodology, discussion of results, implications and recommendations.

Methodology

100 – 250 words

We used a cross-sectional design on four districts, Binga, Chiredzi, Hwange and Matobo. We collected data through face-to-face interviews using structured and semi structured questionnaires, key informants, focus group discussions (FGDs). A sample of 281 participants were drawn from a target population which comprised smallholder small grain farmers. Multi-stage random sampling was employed in Hwange and Matobo that were not engaged on contract farming, two wards and four villages per district and four villages were randomly selected. The study employed simple random sampling to identify farmers who were growing either or both small grain crops. For farmers that were into contract farming (Binga and Chiredzi) non probability/convenient sampling was carried out. Simple random purposive sampling was employed for districts engaged with contract farming. A representative sample was randomly selected with a specific sample size per district calculated proportionally as follows: Binga-60, Chiredzi-95, Hwange-72 and Matobo-54 giving a total of 281 farmers.
Statistical package Stata version 16 was used to analyse household data and the Livelihoods Economic Indicator (LEI) was applied. Households were grouped into four types of vulnerability low, medium, high and very high vulnerability.
Each resilience capital was calculated as the summation of indicators defining the capitals by their respective weights generated from the Principal Component Analysis was specified as:

$$RI = \sum_{c=1}^{S} w_g t_i * indicators$$

RI denotes the individual resilience capital index for V [(human capital (HC), social capital (SC), economic capital (EC), physical capital (PC) and natural capital (NC)] and w_g denotes the weight for each indicator for a given capital ($w_1 = 0.2732; w_2 = 0.1835; w_3 = 0.1134; w_4 = 0.0661; w_5 = 0.0521$).

Results

100 – 250 words

Household level vulnerability

About 46.3% of the sampled households were in the medium vulnerability group, while 26% were in the highly vulnerable group. Only 10.3% were in the very vulnerable group and 17.4% were in the low vulnerable group. However, when aggregated by the district, most sampled households in Hwange and Matobo were more vulnerable to the effects of drought. Majority were growing for subsistence. Results of the study show that farmers in Binga and Chiredzi were less vulnerable. These 2 districts had high land holdings and high ownership of productive

assets such as tractors ploughs, threshers and cars. Reliable market and access to credit through contractors motivated them to produce more.

Table 1: Percentage distribution of Vulnerability in the sampled households by district

Vulnerability groups	Total (%)	Binga	Chiredzi	Hwange	Matobo
Low	49(17.4)	6(10.0)	8(8.4)	19(26.4)	16(29.6)
Medium	130(46.3)	35(58.3)	64(67.4)	17(23.6)	14(25.9)
High	73(26.0)	16(26.7)	19(20)	28(38.9)	10(18.5)
Very high	29(10.3)	3(5)	4(4.2)	8(11.1)	14(25.9)
Total	**281(100)**	**60(100)**	**95(100)**	**72(100)**	**54(100)**

Source: Primary data (2021)

Resilience Analysis

The overall average Agriculture Drought Resilience Index (ADRI) was 4.04 in this population. This indicated that, generally the farmers were moderately resilient. Highest resilience was in Chiredzi with ADRI=4.56(SD=2.11), followed by Binga with ADRI=4.38(SD=1.35) and the least from Matobo with an ADRI=3.32(SD=1.92).

Table 2: Overall ADRI and ADRI indices by district

District	Total	ADRI Mean	SD
Binga	60	4.38	1.35
Hwange	72	3.89	1.20
Chiredzi	95	4.56	2.11
Matobo	54	3.32	1.92
Overall	**281**	**4.04**	**1.74**

Source: Primary data (2021)

Discussion and Conclusion

100 – 250 words

The study results are in consistent with other studies (Coulibaly et al., 2015; IPCC, 2014) that reported that people vary in their vulnerability at the household level. However, when aggregated by the district, most sampled households in Hwange and Matobo were more vulnerable to the effects of drought. These two districts had small land holdings and not under contract farming. The study is supported by Matter et al. (2021) who found out that households with smaller land plots and with less livestock had higher risk of suffering food insecurity. Ifejika Speranza et al. (2008) similarly concluded that having access to cropland larger than 2 ha helped reduce vulnerability to food insecurity in seasons with average or below-average rainfall.

Resilience varied with districts with Chiredzi having the highest resilience and Matobo being the lowest. The study measured livelihoods through the ownership of livestock, remittances, small grain production levels and other economic levels. The study is in support with the findings by Sikwela and Mushunje (2013) who indicated that farmers' livelihoods have a significant and positive impact on smallholder farmers' resilience.

Farmers knew about climate change. There is need to train farmers on climatic adaptation strategies. Since farmers who were more resilient had a number of livelihoods activities including growing of small grains there is need to craft a policy that promotes diversification so that farmers can be able to bounce back when a disaster strikes.