SMALL-SCALE FARMERS' STRATEGIES IN DEALING WITH CRISES:
AN ANALYSIS OF HOUSEHOLD RESPONSES TO CRISIS IN FOUR VILLAGES IN RURAL ZIMBABWE

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by

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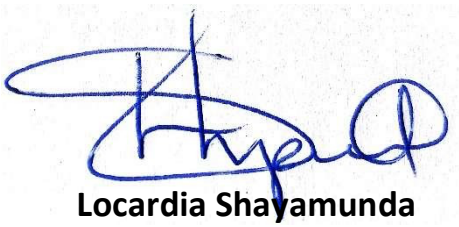
STATEMENT OF ORIGINALITY

I hereby declare that this thesis has not previously been submitted to any other examination commission in Germany or any other country for a degree in the same or similar form. This thesis contains no material previously published or written by another person except where due acknowledgment is properly made.



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'God truly smiled on me in every sense; I am forever grateful for His mercy and grace!' Thank you, Lord, for taking me this far!'

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ABBREVIATIONS

AGRITEX	Department of Agriculture, Technical and Extension Services
DA	District Administrator
DDF	District Development Fund
EU	European Union
GMB	Grain Marketing Board
GoZ	Government of Zimbabwe
HH	Households
ISALCs	Internal Savings and Lending Clubs
NGO	Non-Governmental Organization
RDCs	Rural District Councils
SESs	Socio-ecological systems
SSA	Sub-Saharan Africa

EXECUTIVE SUMMARY

SMALL-SCALE FARMERS' STRATEGIES IN DEALING WITH CRISIS: AN ANALYSIS OF HOUSEHOLD RESPONSES TO CRISIS IN FOUR VILLAGES IN RURAL ZIMBABWE

Crises caused by natural and human-induced disasters have always been part of farmers' lives, but recently they have proliferated through the emergence of new economic, political and environmental challenges. Generally, it is the ordinary poor people, many of them living in the vulnerable contexts of the rural tropics, who are bearing the brunt of these changes. This is particularly true for many countries in Sub-Saharan Africa, where more than two-thirds of the population still depend on agriculture, and a large proportion of rural households suffer from poverty, food insecurity and social unrest. In such contexts, national governments and numerous NGOs, often supported by international donors, become active in supporting small farmers with training programs, the diffusion of technology, credits, social payments, subsidies and infrastructural investments. These efforts have had a remarkable success, except in stopping a general process of local marginalization and environmental degradation. In the end, the vast majority of small-scale farming families are left on their own to face the challenge of sustaining their livelihoods and guarantee food for their families under precarious conditions. More effective measures to support poor rural farmers in Africa are urgently needed that take better account of and stimulate their adaptive capacity to find responses to the manifold challenges.

The research in this thesis aimed to generate empirical insights into farmers' responses to crises as a basis to supporting small-scale farmers more effectively, particularly those in Sub-Saharan Africa, in times of crisis. This includes three specific objectives: (1) to describe how crises changes the conditions for small-scale farmers' activities; (2) to learn how small-scale farmers are responding to thesechanges; and (3) to find out what factors are driving farmers' 'decisions.

To comply with these objectives, the study analyzed in depth the dynamics in four rural villages in Zimbabwe, which represent three typical agricultural contexts in Sub-Saharan Africa: (1) communal agricultural lands with traditional social configurations; (2) agricultural landscapes formed by individualized settlers; and (3) areas resettled in the course of land redistribution programs. Zimbabwe was chosen because it is a prime example of a crisis that brought about severe multi-layered political, economic, social and environmental challenges, especially during the presidency of Robert G. Mugabe between 2000 and 2017. Data were gathered, processed and analyzed using a mixed qualitative and quantitative approach. Household surveys were conducted with lead farmers and extension agents to gain an understanding of the factors and conditions that influence farmers' behavior and choices and to establish categories of farmers. Households were surveyed to determine their characteristics at the personal level (family size, head, level of education, financial situation, and farm experience), the farm level (assets, size, land tenure, remoteness) and the institutional level (extension services, financial support, social organization). Besides, farmers' households that represented the strategies typically used to cope with the situation of crisis were selected for in-depth interviews to learn about the operational details, underlying rationalities and effects of the strategies they had adopted. Expert interviews and participatory mapping exercises with local experts and leaders were conducted to gain an understanding of how the Zimbabwean crisis changed the conditions under which the farmers live and to grasp the range and spatial relevance of strategies adopted by the farmer in response to the changed conditions. Also, secondary sources were systematically explored for relevant information, including reports from international organizations, non-governmental agencies, local NGOs, public research organizations, farmers' groups, dairy associations, Internal Savings and Lending Clubs (ISACs) and government agencies.

The study made three principal findings: (1) crises strongly affected farming households; (2) most farmers managed to respond effectively to crisis situations; and (3) support and resource endowments are critical to overcoming crises.

The crises strongly affected farmers. More than fifteen years of political and economic crises in Zimbabwe, in combination with frequent droughts, profoundly changed the conditions under which rural farmers live and produce. Most strikingly, the manifestation of this complex situation of crises was the breakdown of public services, including progressive reductions of public services providing farmers with technical and financial assistance and, partly related to this, increases in corruption. For example, although the ruling party announced million-dollar tractor and farm mechanization programs during elections, not one of the farmers from the four case studies received anything. Most critical was also the fact that the state-driven Grain Marketing Board failed to continue offering support to maize farmers with regard to pricing and payment patterns,which led to a massive decline in the production of maize, the key business of many farmers at that time. This withdrawal of the state was further compounded by a massive distortion of markets, which for the farmers made the profitable marketing of their own production considerably more difficult or even impossible, as well as making agricultural input prices unaffordable. The latter development forced a majority of farmers to skip using fertilizers, certifiedseeds and pesticides. Some few only managed to apply sub-optimal amounts of fertilizers occasionally on smaller parts of their fields. Devastatingly, farmers also suffered animal losses to drought (especially the extreme drought of the 2015/2016 season) and animal diseases that hampered their practice of using manure to maintain soil fertility. In parallel, farmers were heavilyaffected by climate change, manifested through an increase in dryness, soil erosion and unpredictable rainfall. This was especially hard for farmers acting in the dry conditions that are typical of large parts of Sub-Saharan Africa, where water is the limiting factor of production and where agricultural activities depend on the predictability of rainfall during the sowing period and the availability of groundwater or water reservoirs in the mountains during the growing period. This critical situation was, at least partly, mitigated for more than a third of farmers (38%) throughthe intervention of donors, NGOs and private companies, who, in contrast to the government's initial strategy of diffusing technical packages, promoted low-cost technologies in the case of development organizations and contract farming in the case of private companies. Nevertheless, the situation of crisis resulted in considerable losses of harvests, plants and animals, particularly invery dry years (2002-2003, and 2015-2016), when some crops were a complete write-off, but alsodue to political violence, when livestock and harvests were looted, for example, in the aftermath of the 2008 election. Despite these difficulties, the vast majority of families remained on their properties and tried to cope with the challenging situation. In the resettlement area too, where the government distributed the land of expropriated white farmers, all those farmers who had settled there at the beginning of 2000 remained on their farms and in 2015were joined by new farmers settling on grazing land. Roughly a third of households (29%), however, decided to send amember or two to urban centers, abroad or other farms to search for remunerative employment off the family farm. As it was mostly young male adults who were drawn into leaving the farm forjobs, across all case studies it was common for women, children and the elderly to be left with thetask of managing farm operations.

Effective responses of the farmers. In response to the situation of crisis, the farmers in the case studies employed a wide range of strategies. Responses included orientation towards livestock, the reduction of the land area under cultivation, the adoption of low-input farming systems, intensification, and on and off-farm diversification, as well as migration, a re-orientation to subsistence farming and the unsustainable exploitation of common resources. Most farmers combined two or more of these responses. Where possible nearly all households (84%) started to buy livestock when a crisis broke, whether cattle or small livestock, the latter being seen as resistant to drought and more easily convertible into cash. To improve food security, many farmers (71%) reduced and concentrated inputs on the most suitable parcels of land to optimize the application of scarce resources. Upon realizing surpluses, some farmers (15%) then included tobacco as a cash crop, or even diversified their production portfolios more strongly (20%). Only traditional dairy farmers (10 %) mostly continued their production because, often belonging to the

second or third generation of farmers, they had the knowledge and experience to continue and even intensify production. Also, migration and, relatedly, the transfer of remittances became a central resource for many families (29%). Accordingly, concentration and diversification were closely linked with an orientation to the market. The farmers who produced for markets were well connected with relevant platforms and networks (e.g., tobacco auction floors, milk collection points, the Grain Marketing Board, millers, etc.) and used their surpluses to invest in the farm and grow their asset base. Those farmers who received remittances also invested in farming, often accompanied by a diversification of production. The switch to low-cost technologies and the concentration of production on the most suitable parcels of land massively reduced the dependence on government subsidies. In parallel, many farmers managed to significantly enhance their areal productivity, so that overall production remained stable, despite a significant reduction in the land area under cultivation. Some farmers even managed to increase their gross incomes by intelligently combining on-farm with non-farm strategies. The concentration of farming activities on the most fertile land parcels also allowed fields to be left fallow and promoted other ecologically valuable land-use resources, such as woodlots. This effect was particularly visible in contexts that already showed a high level of degradation. Only 7% of farmers became engaged in unsustainable exploitative activities, but, every tenth household was forced to re-orient itself towards subsistence farming. However, about 75% of households in the case-study sites had somehow found effective ways to cope with crises, implying that the vast majority of farmers substantially changed or strongly adapted their livelihood strategies. While in 2000 most farmers were dedicated to the production of maize and dairy for income generating purposes, in 2016 livelihood strategies were diversified and included the production of food, dairy and cash crops, as well as off-farm employment.

Support and resource endowments are critical. The specific choice and quality of farmers' responses varied strongly in accordance with institutional, farm and personal features, except the consistent orientation towards livestock across all farmers and case studies. In particular, a set of four factors had a highly significant positive influence on the successful actions of farmers, based on concentration, market orientation and diversification, namely the availability of farm assets (particularly ownership of cattle), financial support, the level of social organization and formal tenure arrangements. Market orientation was also favored by accessibility. Other factors had a comparatively low influence on farmers' responses, except a preference for diversification by older and female-headed households. Concerning remittance support, higher educational levels and the good financial situation of the households played a moderately positive role. The picture was less clear concerning factors that influenced responses with questionable livelihood outcomes, such as re-orientation towards subsistence farming (lack of assets, low level of education, households headed by females without husbands) and exploitative strategies (male-headed households and households headed by females without husbands). There were also large differences between the case studies in respect of the factors listed above, partly due to important contextual differences. Most strikingly, the better the situation of a case study with regard to accessibility, water availability and social organization, the stronger the external support. In response, more farmers in the favored case studies exploited the opportunities offered to them mainly by tobacco companies and development organizations (irrigation and dairy farming). One exception was the resettlement case study, which, as a contested area, was disregarded by development organizations, despite favorable environmental conditions. Accordingly, in the least favorable case study, "community in impoverished landscape", households were largely left to face their difficult situations alone. They were more likely to re-orient themselves to subsidence farming and switched to small livestock, thereby managing at least to secure their food basis.

In particular, these results provide three important suggestions for how farmers can be better supported in crises. First, effective water management is key. There is an urgent need to diffuse in-field water-harvesting techniques and to further optimize appropriate agricultural practices, such as mulching and gravity-fed irrigation. Second, farmers are creative in finding solutions. This includes

farming responses, as well as off-farm strategies. Both are effective from a local perspective. However, only the better-off farmers may have the means and capacities for the necessary investments, whereas the challenges may exceed the possibilities of poorer farmers. The proper management of livestock and the use of manure in agricultural production is another important requisite. Third, support measures are critical. However, rather than distributing of costly technology packages, support should take advantage of and promote capacity of farmers to take meaningful decisions. Thus, support should build on the resources and capacities that are available locally and accordingly highlight low-cost strategies and efficient water-use management, stimulate financially attractive options for diversification, and develop existing market opportunities further rather than creating new ones. In this regard, in particular, the frequently observed strategy of farmers to reduce and concentrate inputs on the most suitable land shows an immense potential for optimization. Supporting such promising attempts by farmers to build robust farming systems following their capacities and interests can help achieve development, social equality and sustainability in Sub-Saharan Africa.

To operationalize such an approach requires well-trained extension agents working in well-equipped organizations. Also, the provision of tenure security plays a critical role in motivating farmers to invest and develop the land, as well as to turn land into a bankable asset and collateral that enables farmers to secure bank loans for farm improvements. Equally important is investment in research and development regarding basic infrastructure, particularly the maintenance of public infrastructure, such as roads and bridges, which have largely been neglected due to economic hardships. The ***government*** can also assist farmers by providing market facilities for small livestock and small grains whose markets are still limited. The ***private sector*** has and continues to play an important role in supporting farmers through contract farming arrangements. But they need to consider more intensively weaker farmers who are located far from markets and have to cope with unfavorable situations. ***Farmers' associations*** should prioritize programs and actions that support the frequent and most common response of concentration, as well as market participation and diversification of production. Through the local sharing of information and knowledge, they can guide farmers in reducing their dependence on government subsidies and the use of costly inputs such as fertilizers, certified seeds and pesticides. The **farmers** themselves need to organize themselves better in order to lobby collectively and campaign for technical assistance, credits and secure tenure arrangements. Farmers should intensify crop–livestock integration with livestock, thus equipping farmers with the means to produce much needed inexpensive animal manure to improve soil fertility and to opt for long-term strategies that protect their resource base. Finally, **research** also has its part to play. More knowledge is needed about farmers' actions and rationalities as a basis for finding more effective ways of consolidating the socio-ecological diversity of Zimbabwe, Sub-Saharan Africa and elsewhere, despite the political, economic and climatic challenges that are to be expected in the future.

ZUSAMMENFASSUNG

STRATEGIEN VON KLEINBAUERN IM UMGANG MIT KRISEN: EINE ANALYSE DER REAKTIONEN VON HAUSHALTEN IN VIER DÖRFERN IM LAENDLICHEN SIMBABWE

Krisen, die durch natürliche und vom Menschen verursachte Katastrophen verursacht werden, waren schon immer Teil des Lebens von Bauern, aber in letzter Zeit haben sie sich durch das Auftreten neuer wirtschaftlicher, politischer und ökologischer Herausforderungen vermehrt. Im Allgemeinen sind es die einfachen armen Menschen, von denen viele in den gefährdeten Kontexten der ländlichen Tropen leben, die die Hauptlast dieser Veränderungen tragen. Dies gilt insbesondere für viele Länder in Afrika südlich der Sahara, wo mehr als zwei Drittel der Bevölkerung immer noch von der Landwirtschaft abhängen und ein großer Teil der ländlichen Haushalte unter Armut, Ernährungsunsicherheit und sozialen Unruhen leidet. In solchen Kontexten werden nationale Regierungen und zahlreiche Nichtregierungsorganisationen, oft unterstützt von internationalen Gebern, aktiv, um Kleinbauern mit Trainingsprogrammen, der Verbreitung von Technologie, Krediten, Sozialleistungen, Subventionen und Infrastrukturinvestitionen zu unterstützen. Diese Bemühungen hatten einen bemerkenswerten Erfolg, außer dass sie einen allgemeinen Prozess der lokalen Marginalisierung und Umweltzerstörung aufhalten konnten. Letztlich ist die große Mehrheit der kleinbäuerlichen Familien auf sich allein gestellt und muss sich der Herausforderung stellen, unter prekären Bedingungen ihren Lebensunterhalt zu sichern und die Ernährung ihrer Familien zu gewährleisten. Es werden dringend effektivere Maßnahmen zur Unterstützung armer ländlicher Bauern in Afrika benötigt, die deren Anpassungsfähigkeit besser berücksichtigen und fördern, um Antworten auf die vielfältigen Herausforderungen zu finden.

Die Forschung in dieser Arbeit zielte darauf ab, empirische Erkenntnisse über die Reaktionen von Bauern auf Krisen zu generieren, als Grundlage für eine effektivere Unterstützung von Kleinbauern, insbesondere in Afrika südlich der Sahara, in Zeiten der Krise. Dies beinhaltet drei spezifische Ziele: (1) zu beschreiben, wie eine Krise die Bedingungen für die Aktivitäten von Kleinbauern verändert; (2) zu erfahren, wie Kleinbauern auf diese Veränderungen reagieren; und (3) herauszufinden, welche Faktoren die "Entscheidungen" der Bauern beeinflussen.

Um diese Ziele zu erreichen, analysierte die Studie eingehend die Dynamik in vier ländlichen Dörfern in Simbabwe, die drei typische landwirtschaftliche Kontexte in Afrika südlich der Sahara repräsentieren: (1) kommunale landwirtschaftliche Flächen mit traditionellen sozialen Konfigurationen; (2) landwirtschaftliche Landschaften, die von individualisierten Siedlern geformt wurden; und (3) Gebiete, die im Zuge von Landumverteilungsprogrammen neu besiedelt wurden. Simbabwe wurde ausgewählt, weil es ein Paradebeispiel für eine Krise ist, die schwere, vielschichtige politische, wirtschaftliche, soziale und ökologische Herausforderungen mit sich brachte, insbesondere während der Präsidentschaft von Robert G. Mugabe zwischen 2000 und 2017. Die Daten wurden mit einem gemischten qualitativen und quantitativen Ansatz gesammelt, verarbeitet und analysiert. Haushaltsbefragungen wurden mit leitenden Landwirten und Beratungsagenten durchgeführt, um ein Verständnis für die Faktoren und Bedingungen zu gewinnen, die das Verhalten und die Entscheidungen der Landwirte beeinflussen, und um Kategorien von Landwirten zu bilden. Die Haushalte wurden befragt, um ihre Charakteristika auf der persönlichen Ebene (Familiengröße, Familienoberhaupt, Bildungsniveau, finanzielle Situation, landwirtschaftliche Erfahrung), auf der Ebene des Betriebs (Vermögen, Größe, Landbesitz, Abgelegenheit) und auf der institutionellen Ebene (Beratungsdienste, finanzielle Unterstützung, soziale Organisation) zu bestimmen. Außerdem wurden Bauernhaushalte, die die typischen Strategien zur Bewältigung der Krisensituation repräsentierten, für Tiefeninterviews ausgewählt, um mehr über die operativen Details, die zugrundeliegenden Rationalitäten und die Auswirkungen der von ihnen angewandten Strategien zu erfahren. Experteninterviews und partizipative Kartierungsübungen mit lokalen Experten und Führungspersönlichkeiten wurden durchgeführt, um zu verstehen, wie die Krise die Bedingungen, unter denen die Bauern leben, verändert hat, und um die Bandbreite und räumliche Relevanz der Strategien zu erfassen, die von den

Bauern als Reaktion auf die veränderten Bedingungen angenommen wurden. Außerdem wurden Sekundärquellen systematisch nach relevanten Informationen durchsucht, darunter Berichte von internationalen Organisationen, Nichtregierungsorganisationen, lokalen NGOs, öffentlichen Forschungseinrichtungen, Bauerngruppen, Molkereiverbänden, internen Spar- und Leihclubs (ISACs) und Regierungsstellen.

Die Studie machte drei Hauptergebnisse: (1) die Krisen haben die bäuerlichen Haushalte stark betroffen; (2) die meisten Landwirte haben es geschafft, effektiv auf die Krisensituation zu reagieren; und (3) Unterstützung und Ressourcenausstattung sind entscheidend für die Bewältigung der Krise.

> Die Krisen haben die Bauern stark getroffen. Mehr als fünfzehn Jahre politischer und wirtschaftlicher Krisen in Simbabwe haben in Verbindung mit häufigen Dürren die Lebens- und Produktionsbedingungen der Landwirte tiefgreifend verändert. Am deutlichsten manifestierte sich diese komplexe Krisensituation im Zusammenbruch öffentlicher Dienstleistungen, einschließlich der fortschreitenden Kürzung öffentlicher Dienstleistungen, die den Bauern technische und finanzielle Unterstützung bieten, und, teilweise damit verbunden, in der Zunahme der Korruption. Obwohl zum Beispiel die Regierungspartei während der Wahlen millionenschwere Programme für Traktoren und landwirtschaftliche Mechanisierung ankündigte, erhielt kein einziger der Bauern aus den vier Fallstudien etwas davon. Besonders kritisch war auch die Tatsache, dass das staatlich gelenkte Grain Marketing Board den Maisbauern keine Unterstützung bei der Preisgestaltung und den Zahlungsmodalitäten mehr bot, was zu einem massiven Rückgang der Maisproduktion, dem damaligen Hauptgeschäft vieler Bauern, führte. Zu diesem Rückzug des Staates kam eine massive Verzerrung der Märkte hinzu, die für die Bauern die profitable Vermarktung der eigenen Produktion erheblich erschwerte oder gar unmöglich machte und die Preise für landwirtschaftliche Betriebsmittel unerschwinglich werden ließ. Letztere Entwicklung zwang einen Großteil der Bauern dazu, auf den Einsatz von Düngemitteln zu verzichten, zertifiziertes Saatgut und Pestizide. Einige wenige schafften es nur, auf kleineren Teilen ihrer Felder gelegentlich suboptimale Mengen an Düngemitteln auszubringen. Verheerend ist, dass die Landwirte auch Tierverluste durch Dürre (insbesondere die extreme Dürre der Saison 2015/2016) und Tierkrankheiten hinnehmen mussten, die ihre Praxis der Verwendung von Dung zur Erhaltung der Bodenfruchtbarkeit behinderten. Parallel dazu waren die Landwirte stark vom Klimawandel betroffen, der sich in zunehmender Trockenheit, Bodenerosion und unvorhersehbaren Regenfällen äußerte. Dies war besonders hart für die Landwirte, die unter den trockenen Bedingungen arbeiten, die für weite Teile Afrikas südlich der Sahara typisch sind, wo Wasser der begrenzende Faktor der Produktion ist und wo die landwirtschaftlichen Aktivitäten von der Vorhersagbarkeit der Niederschläge während der Aussaat und der Verfügbarkeit von Grundwasser oder Wasserreservoirs in den Bergen während der Wachstumsperiode abhängen. Diese kritische Situation wurde für mehr als ein Drittel der Landwirte (38 %) zumindest teilweise durch die Intervention von Gebern, NROs und privaten Unternehmen gemildert, die im Gegensatz zur ursprünglichen Strategie der Regierung, technische Pakete zu verbreiten, im Fall der Entwicklungsorganisationen kostengünstige Technologien und im Fall der privaten Unternehmen Vertragslandwirtschaft förderten. Dennoch führte die Krisensituation zu erheblichen Ernte-, Pflanzen- und Tierverlusten, vor allem in sehr trockenen Jahren (2002-2003 und 2015-2016), als einige Ernten komplett abgeschrieben wurden, aber auch aufgrund politischer Gewalt, als Vieh und Ernten geplündert wurden, zum Beispiel nach der Wahl 2008. Trotz dieser Schwierigkeiten blieb die große Mehrheit der Familien auf ihren Grundstücken und versuchte, mit der herausfordernden Situation zurechtzukommen. Auch im Wiederansiedlungsgebiet, in dem die Regierung das Land der enteigneten weißen Farmer verteilte, blieben alle Farmer, die sich Anfang 2000 dort niedergelassen hatten, auf ihren Höfen und 2015 kamen neue Farmer hinzu, die sich auf Weideland niederließen. Etwa ein Drittel der Haushalte (29 %) entschied sich jedoch, ein oder zwei Mitglieder in die städtischen Zentren, ins Ausland oder auf andere Farmen zu schicken, um eine einträgliche Beschäftigung außerhalb

der Familienfarm zu suchen. Da es meist junge männliche Erwachsene waren, die den Hof verließen, um Arbeit zu finden, war es in allen Fallstudien üblich, dass Frauen, Kinder und ältere Menschen mit der Aufgabe der Bewirtschaftung des Hofes zurückblieben.

Effektive Reaktionen der Bauern. Als Reaktion auf die Krisensituation setzten die Landwirte in den Fallstudien eine breite Palette von Strategien ein. Zu den Reaktionen gehörten: die Ausrichtung auf die Viehzucht, die Reduzierung der Anbaufläche, die Einführung von Low-Input-Landwirtschaftssystemen, die Intensivierung und die Diversifizierung innerhalb und außerhalb des Betriebes sowie die Abwanderung, die Neuorientierung auf die Subsistenzwirtschaft und die nicht nachhaltige Ausbeutung der gemeinsamen Ressourcen. Die meisten Bauern kombinierten zwei oder mehr dieser Antworten. Wo es möglich war, begannen fast alle Haushalte (84 %) nach Ausbruch der Krise mit dem Kauf von Vieh, ob Rinder oder Kleinvieh, wobei letzteres als resistent gegen Dürre und leichter in Bargeld umwandelbar angesehen wurde. Um die Ernährungssicherheit zu verbessern, haben viele Landwirte (71 %) reduzierten und konzentrierten die Betriebsmittel auf die an den besten geeigneten Parzellen, um den Einsatz der knappen Ressourcen zu optimieren. Nach dem Erzielen von Überschüssen nahmen einige Landwirte (15 %) dann Tabak als cash-crop auf oder diversifizierten ihr Produktionsportfolio sogar stärker (20 %). Nur die traditionellen Milchbauern (10 %) setzten ihre Produktion meist fort, da sie, oft in zweiter oder dritter Generation, über das Wissen und die Erfahrung verfügten, die Produktion fortzusetzen und sogar zu intensivieren. Auch die Migration und damit verbunden die Überweisung von Rücküberweisungen wurde für viele Familien (29 %) zu einer zentralen Ressource. Konzentration und Diversifizierung waren demnach eng mit einer Orientierung am Markt verbunden. Die Bauern, die für den Markt produzierten, waren gut mit relevanten Plattformen und Netzwerken verbunden (z.B. Tabakauktionshallen, Milchsammelstellen, das Grain Marketing Board, Mühlen, etc. Diejenigen Bauern, die Rücküberweisungen erhielten, investierten ebenfalls in die Landwirtschaft, oft verbunden mit einer Diversifizierung der Produktion. Die Umstellung auf kostengünstige Technologien und die Konzentration der Produktion auf die an den besten geeigneten Parzellen reduzierte die Abhängigkeit von staatlichen Subventionen massiv. Parallel dazu gelang es vielen Landwirten, ihre Flächenproduktivität deutlich zu steigern, so dass die Gesamtproduktion trotz einer deutlichen Reduzierung der Anbaufläche stabil blieb. Einigen Landwirten gelang es sogar, ihr Bruttoeinkommen durch eine intelligente Kombination von innerbetrieblichen und außerbetrieblichen Strategien zu steigern. Die Konzentration der landwirtschaftlichen Aktivitäten auf die fruchtbarsten Parzellen ermöglichte auch das Brachliegen von Feldern und förderte andere ökologisch wertvolle Landnutzungsressourcen, wie z. B. Waldbestände. Dieser Effekt war besonders in Kontexten sichtbar, die bereits einen hohen Grad an Degradation aufwiesen. Nur 7 % der Landwirte gingen einer nicht nachhaltigen, ausbeuterischen Tätigkeit nach, aber jeder zehnte Haushalt war gezwungen, sich auf Subsistenzwirtschaft umzustellen. Allerdings hatten etwa 75 % der Haushalte in den Fallstudienstandorten irgendwie wirksame Wege gefunden, um mit Krisen umzugehen, was bedeutet, dass die große Mehrheit der Bauern ihre Existenzgrundlagen wesentlich verändert oder stark angepasst hat. Während im Jahr 2000 die meisten Landwirte sich der Produktion von Mais und Milchprodukten zur Einkommensgenerierung widmeten, waren 2016 die Strategien zur Sicherung des Lebensunterhalts diversifiziert und umfassten die Produktion von Nahrungsmitteln, Milchprodukten und cash-crops sowie die Beschäftigung außerhalb des landwirtschaftlichen Betriebs.

Unterstützung und die Ausstattung mit Ressourcen sind entscheidend. Die spezifische Auswahl und Qualität der Antworten der Landwirte variierte stark in Abhängigkeit von institutionellen, betrieblichen und persönlichen Merkmalen, abgesehen von der einheitlichen Ausrichtung auf die Viehzucht bei allen Landwirten und Fallstudien. Insbesondere eine Reihe von vier Faktoren hatte einen hochsignifikanten positiven Einfluss auf das erfolgreiche Handeln der Landwirte, basierend auf Konzentration, Marktorientierung und Diversifizierung, nämlich die

Verfügbarkeit von Betriebsmitteln (insbesondere der Besitz von Rindern), finanzielle Unterstützung, der Grad der sozialen Organisation und formale Besitzverhältnisse. Die Marktorientierung wurde auch durch die Zugänglichkeit begünstigt. Andere Faktoren hatten einen vergleichsweise geringen Einfluss auf die Antworten der Landwirte, mit Ausnahme einer Präferenz für Diversifizierung bei älteren und weiblichen Haushalten. In Bezug auf die Unterstützung durch Rücküberweisungen spielten ein höheres Bildungsniveau und die gute finanzielle Situation der Haushalte eine mäßig positive Rolle. Ein weniger klares Bild ergab sich bei den Faktoren, die Antworten mit fragwürdigen Ergebnissen für den Lebensunterhalt beeinflussten, wie z.B. die Umorientierung auf Subsistenzwirtschaft (fehlendes Vermögen, niedriges Bildungsniveau, Haushalte mit weiblichem Haushaltsvorstand ohne Ehemann) und Ausbeutungsstrategien (Haushalte mit männlichem Haushaltsvorstand und Haushalte mit weiblichem Haushaltsvorstand ohne Ehemann). Es gab auch große Unterschiede zwischen den Fallstudien in Bezug auf die oben genannten Faktoren, was teilweise auf wichtige kontextuelle Unterschiede zurückzuführen ist. Am auffälligsten ist, dass je besser die Situation einer Fallstudie in Bezug auf Zugänglichkeit, Wasserverfügbarkeit und soziale Organisation war, desto stärker war die externe Unterstützung. Dementsprechend nutzten mehr Bauern in den begünstigten Fallstudien die Möglichkeiten, die ihnen vor allem von Tabakfirmen und Entwicklungsorganisationen geboten wurden (Bewässerung und Milchwirtschaft). Eine Ausnahme bildete die Fallstudie Umsiedlung, die als umstrittenes Gebiet trotz günstiger Umweltbedingungen von den Entwicklungsorganisationen nicht beachtet wurde. Dementsprechend wurden in der ungünstigsten Fallstudie, "Gemeinde in verarmter Landschaft", die Haushalte weitgehend mit ihrer schwierigen Situation allein gelassen. Sie orientierten sich eher auf Subsistenzlandwirtschaft um und stiegen auf Kleinviehhaltung um, wodurch es ihnen gelang, zumindest ihre Nahrungsgrundlage zu sichern.

Diese Ergebnisse liefern vor allem drei wichtige Anregungen, wie Bauern in Krisen besser unterstützt werden können. Erstens: Ein effektives Wassermanagement ist der Schlüssel. Es besteht ein dringender Bedarf, Techniken zum Sammeln von Wasser auf dem Feld zu verbreiten und geeignete landwirtschaftliche Praktiken wie Mulchen und Schwerkraftbewässerung weiter zu optimieren. Zweitens sind die Landwirte kreativ bei der Suche nach Lösungen. Dazu gehören sowohl landwirtschaftliche als auch außerlandwirtschaftliche Strategien. Beide sind aus lokaler Sicht effektiv. Allerdings haben möglicherweise nur die besser gestellten Bauern die Mittel und Kapazitäten für die notwendigen Investitionen, während die Herausforderungen die Möglichkeiten der ärmeren Bauern übersteigen können. Die richtige Haltung von Nutztieren und der Einsatz von Dung in der landwirtschaftlichen Produktion ist eine weitere wichtige Voraussetzung. Drittens sind Unterstützungsmaßnahmen entscheidend. Anstatt jedoch teure Technologiepakete zu verteilen, sollte die Unterstützung die Fähigkeit der Landwirte nutzen und fördern, sinnvolle Entscheidungen zutreffen. So sollte die Unterstützung auf den lokal vorhandenen Ressourcen und Kapazitäten aufbauenund dementsprechend kostengünstige Strategien und effizientes Wassernutzungsmanagement hervorheben, finanziell attraktive Optionen zur Diversifizierung anregen und bestehende Marktchancen weiterentwickeln, anstatt neue zu schaffen. Insbesondere die häufig zu beobachtender Strategie der Landwirte, Betriebsmittel zu reduzieren und auf die am besten geeigneten Flächen zu konzentrieren, zeigt in dieser Hinsicht ein immenses Optimierungspotenzial.

Die Unterstützung solcher vielversprechenden Versuche von Bauern, robuste landwirtschaftliche Systeme nach ihren Fähigkeiten und Interessen aufzubauen, kann dazu beitragen, Entwicklung, soziale Gleichheit und Nachhaltigkeit in Afrika südlich der Sahara zu erreichen.

Die Operationalisierung eines solchen Ansatzes erfordert gut ausgebildete Berater, die in gut ausgestatteten Organisationen arbeiten. Außerdem spielt die Sicherheit der Besitzverhältnisse eine entscheidende Rolle bei der Motivation der Landwirte, in das Land zu investieren und es zu entwickeln sowie das Land in einen bankfähigen Vermögenswert und eine Sicherheit zu verwandeln, die es den Landwirten ermöglicht, Bankkredite für die Verbesserung der Landwirtschaft zu erhalten. Ebenso

wichtig sind Investitionen in Forschung und Entwicklung in Bezug auf die Basisinfrastruktur, insbesondere die Instandhaltung der öffentlichen Infrastruktur wie Straßen und Brücken, die aufgrund der wirtschaftlichen Schwierigkeiten weitgehend vernachlässigt wurden. Die Regierung kann den Landwirten auch helfen, indem sie Markteinrichtungen für Kleinvieh und Kleingetreide bereitstellt, deren Märkte immer noch begrenzt sind. Der private Sektor hat und spielt weiterhin eine wichtige Rolle bei der Unterstützung der Landwirte durch Vertragslandwirtschaft. Aber sie müssen sich intensiver um schwächere Landwirte kümmern, die weit von den Märkten entfernt sind und mit ungünstigen Situationen zu kämpfen haben. Bauernverbände sollten Programme und Aktionen priorisieren, die die häufige und häufigste Reaktion der Konzentration sowie die Marktteilnahme und Diversifizierung der Produktion unterstützen. Durch den lokalen Austausch von Informationen und Wissen können sie die Landwirte dabei unterstützen, ihre Abhängigkeit von staatlichen Subventionen und dem Einsatz von teuren Betriebsmitteln wie Dünger, zertifiziertem Saatgut und Pestiziden zu verringern. Die Bauern selbst müssen sich besser organisieren, um kollektiv Lobbyarbeit zu betreiben und sich für technische Unterstützung, Kredite und sichere Besitzverhältnisse einzusetzen. Die Landwirte sollten die Integration von Ackerbau und Viehzucht intensivieren und so den Bauern die Mittel an die Hand geben, den dringend benötigten kostengünstigen Tierdünger zu produzieren, um die Bodenfruchtbarkeit zu verbessern und sich für langfristige Strategien zu entscheiden, die ihre Ressourcenbasis schützen. Schließlich muss auch die Forschung ihren Teil dazu beitragen. Es wird mehr Wissen über die Handlungen und Rationalitäten der Bauern benötigt, um effektivere Wege zu finden, die sozio-ökologische Vielfalt in Simbabwe, Subsahara-Afrika und anderswo zu konsolidieren, trotz der politischen, wirtschaftlichen und klimatischen Herausforderungen, die in Zukunft zu erwarten sind.

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1 INTRODUCTION

1.1 Problem statement

Crises have become a way of life in many parts of the world, just to mention the Global Food Crisis of 2003–2008, the Global Economic Crisis of 2007–2009, frequent natural and human-induced disasters, and ongoing civil wars in many African and Asian countries contributing to the current refugee crisis. There is a common sense understanding that the frequency of such crises may even accelerate in the future, with serious global consequences (Ollivaud and Turner, 2014). Generally, it is the ordinary poor people, many of them living in vulnerable circumstances in the rural tropics, who bear the brunt of such events (Philip and Rayan, 2004). This is particularly true for many countries in Sub-Saharan Africa, where more than two thirds of the population still depend on agriculture (Sisay et al., 2019; FAO, 2015; Kiptot et al., 2014; Bryn et al., 2013), a large proportion of rural households suffer from poverty, food insecurity and social unrest, and the state has limited capacity and/or willingness to respond to and mitigate the threats to the local population or to provide adequate levels of protection (FAO 2010); Haile 2005).

In such contexts, national governments and numerous NGOs, often supported by international donors, have become active in supporting small farmers with training programs, the diffusion of technology, credits, social payments, subsidies, and infrastructural investments (Rauh, 2010; World Bank 2008). These efforts have had remarkable success but have not been too successful in stopping a general process of local marginalization and environmental degradation (Jensen and Lonergan, 2012). In the end, the vast majority of small-scale farming families are left to their own devices in facing the challenge of sustaining their livelihoods under precarious conditions (Harvey et al. 2014; Pokorny 2013; Wolfenson 2013).

More effective measures are therefore urgently needed that better take into account and support farmers' adaptive ability to find responses to the manifold challenges that face them (Campbell and Goddard, 2015; Schaar 2013; UNISDR, 2009). A wide range of locally devised strategies have been documented that vary according to each farmer's priorities, routines, and available assets (Lunga and Musarurwa 2016; Quinn et al. 2011; FAO 2010). Farmers have proved to be creative in exploring options to guarantee their continued satisfaction of their households' basic domestic consumption and other pressing needs (Pannell et al., 2014). However, for a number of reasons (Haile, 2005; Conning, 2002; Dercon, 2002), they might opt for unsustainable solutions (Frankenberger and Goldstein 1990), abandon their farms and migrate to urban centers, or even migrate abroad in search of a better life (FAO, 2010; Mortimore and Adams 2001).

While well-designed but exemplary studies of small farmers acting in times of crisis exist, there is a need for a more systematic qualitative and quantitative assessment of the scope, local relevance, and degree of success of local families' strategies to cope with crises. This can provide valuable insights into the design of support measures that take into account local realities and preferences, build on available local skills and capacities, and thus achieve better results at lower costs when compared to the classic top-down implementation of solutions devised by non-local experts.

Against this backdrop, the research in this thesis aims to generate empirical insights into farmers' responses to crises as a basis to supporting small-scale farmers, particularly those in Sub-Saharan Africa, more effectively in times of crisis. This aim has three specific objectives: (1) to describe how crises change the conditions in which small-scale farmers act; (2) to learn how small-scale farmers respond to these changes; and (3) to determine what factors are driving farmer's decisions.

To comply with these objectives, the study analyzed in depth the dynamics of four rural villages in rural Zimbabwe representing three typical agricultural situations in Sub-Saharan Africa: (1) communal agricultural land with traditional social configurations; (2) agricultural landscapes created by individualized settlers; and (3) areas resettled in the course of land redistribution programs. Zimbabwe

was chosen because it represents a prime example of a crisis involving severe, multi-layered political, economic, social, and environmental challenges, especially during the presidency of Robert G. Mugabe between 2000 and 2017.

The following sections of this introduction outline the situation of smallholders and the farming sector in Africa and explain the phenomenon of crisis in general and with particular reference to Zimbabwe. This is followed by the review chapter, Chapter 2, which assesses the state of existing knowledge on the research questions, more specifically the manifestations of crisis from the farmers' perspectives, their responses to crises, and the underlying rationalities and influencing factors. Chapter 2 concludes by describing the conceptual framework that has guided the empirical analysis. The case study, villages and methodologies used are presented in Chapter 3. Chapter 4 then presents the empirical findings from the case studies of local manifestations of crisis, farmers' responses to them and the influencing factors. The thesis ends with a discussion of main findings and lessons learnt, as well as recommendations for those working on development and research with smallholders in sub-Saharan Africa.

1.2 Farmers and farming in Africa

'Farmer is a term used to describe those who live and work on a farm and who earn at least some of their income from agricultural enterprise. Such individuals cultivate land to produce a variety of crops, vegetables, and fruits, often in combination with livestock production. Due to this combination of production, more specific terms are commonly used to denote farmers based on their major concentration, for example, livestock producers, especially those who raise grazing livestock like cattle, goats, and sheep, are known as ranchers in Australia and the United Kingdom (Murgueitie *et al*., 2011), but in Africa are referred to as pastoralists or cattle- or goat-herders (Jacobs, 1965), while farmers who engage in the production of milk from milk-producing animals are known as dairy farmers (Khan *et al*., 20113). A farmer who concentrates on the production of small forms of livestock like chickens, turkeys, ducks, etc. for meat or eggs, as well as to earn an income, is commonly referred to as a poultry farmer. Similarly, a farmer who raises a variety of vegetables for sale in a market is often known as a market gardener. A farmer who raises sufficient food crops for household consumption but not for external sale is commonly referred to as a subsistence farmer, whereas a small-scale farmer is one who produces food both for his or her own consumption and for the market (Baiphethi and Jacobs, 2010). Alternatively, farmers may be defined by their land-tenure systems, such as whether they have formal or legal ownership, formal user rights, or communal or collective tenure rights (Peters, 2009). In developed economies, farmers usually own the land on which they live and farm, whereas in developing economies the majority of farmers live on state land using customary or collective tenure rights (Chimhowu and Woodhouse, 2006).

Most farmers in Africa are family farmers who rely largely on family labor to produce both their own food and some for sale. In the absence of mechanization, this means that most of the work is done by the women and children. As a result, during the peak labor period children miss school, thus perpetuating the cycle of poverty, as the uneducated marry the uneducated and continue to live on the land in precarious circumstances. From a gender perspective, women are marginalized and bear the brunt of harsh land-based economies, hardships brought about by unpredictable rainfall patterns, while most of the men migrate to urban areas to look for off-farm employment. These family farmers comprise a diverse range of relatively small-scale socio-economic structures with limited landholdings used to pursue a wide range of agricultural, pastoral and natural resource-management activities (Moyo, 2016). There is no official definition of family farmers in Africa, though terms such as 'small-scale' or 'smallholder' farmers are commonly used by scholars and governments alike (Moyo, 2016). Small-scale or smallholder farmers are comparative terms used to distinguish these farmers from the medium- and large-scale commercial farmers, plantations and estates that are also found across many African countries. Small-scale farmers are generally treated derogatively by scholars and experts, who often categorize them as 'traditional' or 'backward' subsistence farmers, inferior technologically and lacking the profit motive compared with large-scale commercial farmers, who in turn are largely linked

to financial and commodity markets (Moyo, 2016). In some cases, small-scale farmers are incorrectly called 'communal farmers' even when they are not located in what are communal areas per se. Ideally, small-scale farmers are clearly small-scale family farms that mostly depend on family labor to produce a substantial share of their food, as well as a surplus that can be sold to raise a bit of income. There is a diversity of small-scale farmers in Africa alongside the diversity of their situations, as is noticeable when terms for and the key distinctive principles of small-scale farmers in Africa are to be considered. There is a tendency to lump all small producers under the single umbrella term 'small-scale' or 'smallholder farmer', but the different farmer types that exist in Africa include peasants, squatters, resettled, subsistence, contract and small-scale farmers. However, the logical meanings of what is 'small' are attached to the farming systems themselves: thus, 'small-scale' refers to the scale of production, 'smallholder' to the small size of the land or farm unit. These are important meanings in the study of African farming systems, as well as being useful in differentiating them from the large-scale farming systems – large, that is, in terms of land size, as well as historically, in terms of their productive output and intensity. Of course, these terms are fluid, not to mention debatable or contestable, especially among academics. Table 1 lists the differences among these farmers in respect of their main characteristics. The here listed various names, given to family farmers under the umbrella terms of 'small-scale' or 'smallholder farmers', usually reflect different levels of knowledge of the specific social, economic and environmental features that are embedded in their diversity (Borges Serra, 2019).

Peasant farmers are family farmers who cultivate land as small-scale landowners or farm workers. There is no agreed definition of 'peasantry' among scientists, but the term connotes small landholdings, low incomes, very little or no education, and traditional communities generally making decisions based on their community values. 'Peasant is therefore a term used to describe a relatively poor farmer who owns, rents or works on a small farm. The same term 'peasant' can also be used to mean 'an unsophisticated farmer' (FAO, 2015). The reliance of the designation 'peasant' on tradition, culture and community norms attributes them with some form of self-governing authority and exclusive land rights which may make them closed communities, though they also participate partially in markets (Edelman, 2013). The term 'peasant' is widely used in the social sciences and by many cultural anthropologists in analyzing the social and cultural characteristics of rural family farmers (Edelman, 2013). While in developed nations peasants have slowly disappeared with the consolidation of farming plots into larger units and the industrialization of agriculture, in many developing nations, particularly in Africa, peasants still exist because of the low levels of farm mechanization (Edelman, 2013). Even though farm mechanization is still low among poor rural family farmers in Africa, they do not rely solely on cultivating land but engage in a wide variety of activities both on- and off-farm previously called 'occupational multiplicity' and later widely discussed by others as 'pluriactivity' or 'the new rurality' (Kay, 2008).

Squatters are family farmers who occupy an abandoned or unoccupied area of land without permission to do so. The squatter therefore does not own land on which he or she resides and may be subjected to eviction at any time. Squatting is a common phenomenon across the world and occurs when those who are poor and landless find an empty plot of land to occupy, whether state land or land belonging to an absent landlord (Penalver, 2008). However, some squatters may rent land from farm-owners, land companies and/or absentee landlords (Saff, 2010). In Africa, there is a specific historical background to what white farmers called squatters. According to the latter, Africans who lived and worked on their farms were often referred to as 'squatters' and were a pronounced featureof the twentieth-century sub-Saharan settler societies (Youe', 2002). In the beginning, white settlers allowed their African workers to settle on the same farm, clear land, grow crops and graze livestock while providing seasonal labor for the white farmers. Later, however, white farmers used their political influence to define them as squatters and declare their occupation of land illegal (Youe', 2002). Moreover, capitalist white farmers regarded any native farmers not living in the created reserves as squatters (Penalver, 2008). The term 'squatter' has thus continued to be used until this day. The

landless who invaded white commercial farms were regarded as 'squatters.' Actions viewed as 'political' weapons or strategy forced the government to regularize their illegal occupation (Saff, 2010).

Table 1. Type and main features of farmers in Africa

Type	Main features						Authors
	Tenure	Labor systems	Land size	Systems of production	Capital inputs	Use of outputs	
Peasant	Communal	Family (women and children)	Small	Traditional, poor unsophisticated farming communities	Minimum	Mainly for home consumption (subsistence) and surplus sold on markets	Edelman, 2013
Squatters	Illegal land occupiers	Family		Traditional	Minimum	Home consumption	Penalver, 2009; Youe, 2002; Saff, 2010
Resettlement farmers	Beneficiaries of land reform or redistribution programs (on state land/ Leasehold system	Family – some government-sponsored mechanization	mixture of medium and small	Mix of both traditional and modern mechanized	Varies among farmers	A mix	FAO, 2004; Chiremba and Chambers, 2003; Matondi, 2012; Scoones et al., 2018; Moyo
Subsistence farmers	Communal	Family labor (women and children)	Small	Traditional	Low	Produce for own consumption, often engage in low-return activities	FAO, 2015; Edelman, 2013; de Janvry and Sadoulet, 2011; Baiphathi and Jacobs, 2009; Pretty *et al*., 2011;
Small-scale farmers	Freehold African Purchase areas (small individualized farm property)	Both family labor and some hired labor	Small relative to large-scale commercial farms (previously white-owned) but much bigger than the communal land units	Mixed	Average	Some consumption and market oriented small-scale production on relatively small individualized farm properties	Moyo, 2016; Fischer and Qaim, 2012; Bangwayo-Skeete *et al*., 2010; Nel and Mabhena, 2020; Scoones *et al*., 2017
Contract farmers or out-growers	Freehold, leasehold, and communal	Family and some hired labor	Mixture of large, medium and small land units	Mix of both tradition and modern mechanized	Grow tobacco with support from private companies	A mix	FAO, 2001; Moll *et al*., 2004; FAO, 2017; Moyo, 2016; Kirsten and van Zyl, 1998
Medium-scale commercial farmers	Beneficiaries of land reform or redistribution programs (on state land leasehold system)	Family labor– some government-sponsored mechanization	Mixture of medium and large systems of productions-modern mechanized	Modern mechanized	Capitalized	Market-oriented	Scoones *et al*., 2017; Jayne *et al*., 2016; Gwiriri *et al*., 2019; Sitko and Jayne, 2014; Scoones *et al*., 2018
Rural family farmers	Communal	Depend mostly on family labor	Small land holdings	Traditional	Minimum	Own consumption	Moyo, 2016;
Large-scale commercial farmers	Freehold (large individualized farm property)	Mostly hired and with government sponsored mechanization	Large-scale farms	Modern mechanized	Well capitalized	Market oriented	Moyo, 2016;

Subsistence farmers grow most of their food crops to meet their household consumption needs; their output often being aimed at ensuring their survival using local or indigenous crop varieties that give

them little or no marketable surplus. According to the FAO (2015), subsistence farmers make decisions primarily to satisfy their household food requirements, only going to market infrequently to raise an income. In some cases, subsistence farmers are referred to as peasants or subsistence peasants due to their low productivity level. In recent years, some subsistence farmers are reported to be actively participating in markets by going beyond their focus on self-sufficiency, although their market activity remains limited due to several factors that hinder them from increasing productivity (de Janvry and Sadoulet, 2011). Subsistence farmers are not a homogeneous group but differ depending on the farming techniques they employ. Four categories of subsistence farmers are widely identified: shifting, primitive, nomadic herding, and intensive subsistence farmers. Shifting cultivators move from one plot of land to another when the land they have been working, often allocated by local leaders, can no longer produce enough (Baiphathi and Jacobs, 2009). As the fertility of the land declines, such farmers move on to forest land for agricultural purposes and abandon now infertile land, which can lay farrow for decades, allowing its vegetation to regrow and restore soil fertility as well as biomass (Pretty *et al*., 2011). In contrast, primitive farmers use the 'slash-and-burn' technique and open up new land, as the majority of these farmers have smaller fields to work on such as gardens, which they often establish near their homesteads or along river banks, but within proximity to where they live. In these gardens, 'primitive' farmers practice intensive 'non-shifting' techniques using ash from burning as fertilizers, household refuse, livestock manure or compost to fertilize their crops (Edelman, 2013). Farmers often irrigate such fields and recognize the value of the regular use of compost and organic manure on their smaller fields.

Resettled farmers are beneficiaries of land-reform programs that have been implemented by many African governments as a way to address the land imbalances created by former colonial governments (FAO, 2004). In the context of southern Africa, both social imbalances and political pressure emanating from an unbalanced distribution of land has compelled national governments to devote themselves to land redistribution (Fischer and Qaim, 2012; Bangwayo-Skeete *et al*., 2010). As a result, land-reform policies have been implemented in southern Africa, placing classic debates on land redistribution on regional agendas among both politicians and scientists. Discussions on land redistribution have affected several fields and perspectives, from politics to academics and from international donors to national development agencies (Nel and Mabhena, 2020; FAO, 2004). Different resettled farmers occupy different plots of land normally grouped under the two categories of small-scale and medium-scale. The distinction between these two categories relates to the area of land they hold. Resettled farmers comprise a wide range of categories, from new farmers to often educated business people and civil servants (Scoones *et al*., 2017).

Contract farmers are small-scale farmers who enter into a contract with private companies, which in turn buy and process their crops. Contract farmers mostly produce cash crops on their land as 'out-growers' on contract to agro-processing companies. In African history contract farming is nothing new but has a long history dating back to the colonial period, when contract farmers were contracted largely for the production of major cash crops such as cotton, sugarcane, cocoa and tobacco (FAO, 2001). This type of farming is often referred to as an 'inclusive business model' embedding contract farmers into commercial value chains (Moll *et al*., 2004). It has been argued by others that contract farming is a 'win-win' solution, particularly for poorly resourced farmers wanting to participate actively in global markets without their being dispossessed, as they will continue to work on their land using family labor while also accessing commercial value chains (Moll *et al*., 2004). In many parts of Africa, contract farming provides a crucial livelihood, particularly for rural poor households. Others have argued that, in deciding on contract arrangements, contract farmers have both the risks and the benefits of linking themselves to marketable value chains (FAO, 2017). The benefits of contract farming largely depend on the terms of the contracts in respect of whether they will make a profit or not, fall into debt or come to depend entirely on contractors' commercial investments.

Conceptually, ***small-scale commercial farmers*** are small-scale family farmers using family labor to produce for household consumption while also engaging in wider markets (Moyo, 2016). Their

landholdings are relatively smaller than medium and large-scale commercial farms with landholdings running from a few hundred to thousands of hectares per family farm. Therefore, the scope of production and productivity of small-scale commercial farmers remains highly constrained, though this is dependent on the diversity of social, agro-ecological and economic conditions, including in terms of the uneven extent of their holdings and their various forms of assimilation into a variety of commodity and input markets (Moyo, 2016). Small-scale farms are often perceived negatively in terms of their viability or a viable farm size, which has profound negative effects on the relative profitability of such farmers (Kirsten and van Zyl, 1998). There is scientific evidence showing that small-scale commercial farmers in Africa are often excluded from assistance and subsidies and do not qualify in terms of 'viable size', restricting their potential to become competitive and to fully develop their potential into viable niches for a strong smallholder sector in the future (Kirsten and van Zyl, 1998).

Medium-scale commercial farmers are family farmers with relatively large landholdings compared to small-scale farmers. They are a relatively new class of 'middle farmers' in Africa whose growth and development have been documented in recent agrarian change studies in the continent (Scoones *et al*., 2017; Jayne *et al*., 2016). Medium-scale farmers in Africa are often educated business people and civil servants using their own money earned from non-farm activities which they invest in medium-scale commercial farms they own and operate themselves. There have been several past attempts by colonial administrators and post-independence governments to create a class of 'emergent' commercially oriented farmers cultivating more than five and up to twenty hectares of land (Gwiriri *et al*., 2019; Sitko and Jayne, 2014). The development and rise of the emergent farmers have been hailed by others as an effective model for achieving agricultural growth and poverty reduction in Africa (Sitko and Jayne, 2012). However, Gwiriri and others (2019) have warned against perceiving emerging farmers as a homogeneous group and not taking into consideration the differences between them. A recent study entitled 'Unpacking the Emergent Farmer Concept in Agrarian Reform…' in South Africa found that, despite having acquired private farms, some farmers remain effectively subsistence farmers (Gwiriri *et al*., 2019). Other researchers, however, show a significant increase in the growth of medium-scale farmers, for example, in Ghana and Zambia. Such farmers are reported to hold more land than small-scale farmers, most of which have less land than five hectares per family (Jayne *et al*., 2016). The growth of medium-scale farmers shows that they control 20% of total farmland in Kenya, 32% in Ghana, 39% in Tanzania and over 50% in Zambia (Jayne *et al*., 2016). This reflects the increased interest in land for farming purposes by a variety of people, including urban-based professionals and influential rural residents who often use non-farm income to invest in farming (Scoones *et al*., 2018). In terms of land ownership and/or tenure arrangements for medium-scale farmers, this differs across countries, with some having acquired access to private farms through land redistribution on long leases (Gwiriri *et al*., 2019), while others have done so through the accumulation of land from smaller plots by buying more through local land markets or acquisition via political and other connections (Scoones *et al*., 2018). Scientific and political debates and analyses of the role of medium-scale commercial farms have recently returned across the African continent with a particular focus on the role changing farm size distributions would have on the production of both food and cash crops (Jayne *et al*., 2016; Sitko and Jayne, 2014).

Rural family farmers are a multi-functional unit of social organization that rear livestock, grow food or cash crops, and engage in other non-farm activities as a means of livelihood. They are multi-functional producers and consumption units whose production meets a wide range of their consumption and income needs, particularly when they actively engage with markets (Moyo, 2016). In almost all African countries, family farmers' production is structured around the individual family unit, with their own fields or user rights, with raising livestock, farming and natural resource management activities possibly being jointly undertaken on the available common property (Moyo, 2016). Such farmers often work together on their crop fields focusing on food crops or mixed crops and tending their livestock. Family farmers also exploit owned natural resources and those that are commonly shared with other community members, and they often use ecologically sensitive collective management practices that are sustainable in the reproduction of their land and natural resources (Moyo, 2016). Although the

majority of rural family farmers are devoted to the production of food for their own consumption, others sell food in a limited way that nonetheless makes available significant amounts of staple food crops and cash crops, thereby feeding millions of people and contributing towards export earnings. The scope, production and productivity of rural family farmers remain constrained, though obviously with variations based on several factors, such as climatic conditions, personal features, the degree and intensity of disasters, and the uneven extent and varied forms of integration into different types of commercial market (FAO, 2017).

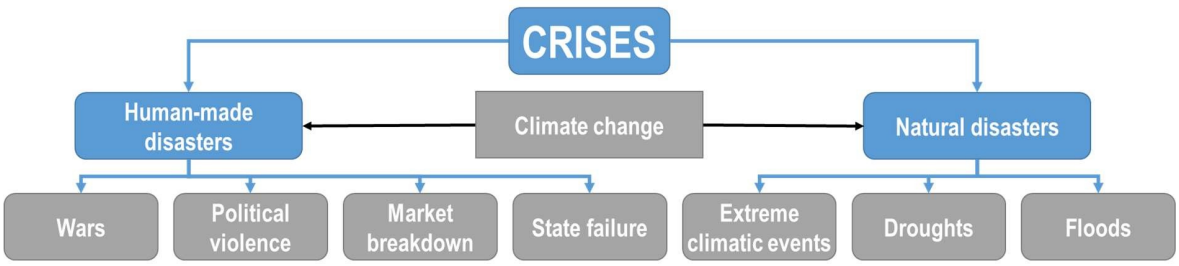
The majority of rural family farmers live in remote areas, but a large proportion of them have access to urban areas, which tends to influence the decisions they make on what and how much to grow. However, often conforming to a specific traditional culture which is closely linked with the way of life of small rural communities, they are also affected by both internal and external factors (Edelman, 2013). Family members may also find part-time jobs in urban centers as a way to earn an income for the family. However, due to the scarcity of non-farm jobs and the prevalence of low employment incomes (Moyo and Yeros, 2005a), many opt for other sources such as diversification through the exploitation of natural resources.

Large-scale commercial farmers are a result of colonialism, which ushered in large-scale farming in Africa, together with a promise to modernize farming while creating jobs for the local population. However, this came about at the latter's expense, as they lost their land rights, were dispossessed of their land and exploited as cheap labor (Moyo, 2016). Large-scale commercial farms are characterized by large plantations or a single crop type, commonly referred to as 'monoculture', and such farmers have few if any links with local economies, as much of their farm produce is produced for export. These farmers often buy their inputs overseas, supplying global markets while bypassing local intermediaries. The majority of large-scale commercial farmers in Africa own large tea, coffee, sugarcane, cotton, banana, macadamia nut or cocoa plantations. They rely on cheap hired labor often of migrants from neighboring countries, as well as from poor, less educated local people. Some of these farms were taken over by the state after independence, but more continue to be dissolved through land redistribution programs benefiting local farmers (Moyo, 2016; Mutondi, 2010; FAO, 2004).

1.3 Crises

A crisis is a situation in which a complex system experiences negative changes in social and physical respects, as well as in production, markets, support and security, that often threaten the local livelihoods of an individual, group, community or the entire society and occur with little or no warning. Other characteristics of a crisis include the unexpected, the uncertain, and threats to those affected (Seeger, Sellnow, and Ulmer, 1998). The reasons for these disasters are manifold (Figure 1), but they can be grouped into two categories, namely human-induced and natural disasters respectively (IPCC, 2019 & 2012; Gähler, 2016). However, under the former, many scientists agree that human activities are accelerating climate change (IPCC, 2019; Gähler, 2016), which also threatens local livelihoods due to extreme weather events such as heat waves, droughts and storms (Brazier, 2017).

Figure 1. Reasons for crises



1.3.1 Human-induced disasters

There is no single definition of human-made disasters (Hallegatte and Przyluski, 2010). The phrase may refer to disastrous events emanating from wars, political violence, the breakdown of markets and state failure. Human-made disasters may be the result of a wide range of policies and deliberate state actions generating severe conditions that disrupt the community's or society's ability to function (Goldsteen and Schorr, 1982). The most common elements of man-made disasters involve human intent, negligence, error or failure of a man-made system (Harding, 2007). Examples of human-made disasters are many but include wars and political violence, market collapse and state failure. While wars often refer to armed conflicts, the word may also extend to subtle wars involving politically motivated violence in which people are abducted, tortured, maimed and/or killed in activities carried out for political aims that benefit a minority group (FAO, 2017; FAO, 2012; Harding, 2007). State failure is often characterized by the actions of repressive governments and the state's limited capacity or unwillingness to protect or mitigate the threats to local populations, including policy inconsistencies (Haile 2005; FAO 2010). Such practices generate a wide range of adverse conditions that threaten local livelihoods, particularly those of poor farmers located in vulnerable and marginalized contexts such as semi-arid areas (Harding, 2007). The consequences of human-made disasters are much broader in scope, and as such wars and political violence produce both direct and indirect negative effects. These consequences are discussed in detail under the section on manifestations of crises.

Wars

War refers to a state of conflict between groups of people within a country or even between countries. War is characterized by the use of weapons, military groups and/or soldiers, as well as the enforcement of rights through force by a government (Annan, 2014; Olaosebikan, 2010). Wars have existed throughout history and have involved armed forces (Olaosebikan, 2010). Wars may be caused by a multiplicity of factors, such as human-rights violations, poverty, bad governance and corruption, incompetent political leadership, the marginalization of minority ethnic groups and the proliferation of small arms (Annan, 2014). Also, borders created by colonial powers have been sources of war to some countries (Olaosebikan, 2010). Scientific research has recorded how weak, corrupt and unpatriotic some African leaders have proved to be (O'Brien and Leichenko, 2003), which in itself has triggered wars such as those in the Sudan, Nigeria, Algeria and Liberia (Olaosebikan, 2010).

Across the world, there are many examples of wars that have had particular impacts, such as the destabilization of Iraq following the US-led war on an already weakened state, which caused high levels of political instability and violence (UNDP, 2005). In Asia, examples include the 2006 Mexico Drug War (Seele *et al*., 2010), the 2011 Yemen civil war (Orkaby, 2015) and the Syrian civil war (Syrian Civil War Map, 2020). In Europe, there is the 2014 war in Donbas in Ukraine (Malyarentko and Wolff, 2019; Averre, 2016). In Africa, one can cite the 1991 Somali civil war (Menkhaus, 2007), the 2014 Libyan civil war (Baum and Zhukov, 2015), the ethnic violence of 2011 in South Sudan, the South Sudan civil war (de Waal, 2014) and the communal conflicts in Nigeria (Oji *et al*., 2010).

Political violence

Political violence refers to violence perpetrated by state actors on non-state actors to achieve political goals such as maintaining power. Due to civil unrest, most of the wars that research has documented are called civil wars, but political violence also takes the form of intimidation, abductions, maiming and killings by state actors and/or non-state actors (Blattman and Miguel, 2010). However, due to the small-scale nature of killings compared to mass killings during wars, political violence seems to attract less attention from both scientists and the media, even though its effects are more or less the same (Straus, 2012). Political violence can result from competition over scarce resources such as land, minerals and water, which, if not addressed promptly can trigger conflicts between herders and farmers, as has been widely reported by many researchers (FAO, 2017).

Breakdown of the rule of law

The breakdown of the rule of law refers to the weakening of a country's legal system. This may influence people to engage in punishable offenses intentionally, as they can bribe law enforcement agents and therefore erode respect for law and the personal responsibility for abiding by the laws, rules and regulations of a community, region or country. Disasters may be precipitated by the lack of observance of the law and in agriculture may in turn cause serious land degradation, for example, cutting down trees, illegal mining and other destructive activities farmers may engage in. While it can be argued that one factor that influences the level of an illegal activity like cutting down trees or illegal mining is the probability that offenders will be arrested and punished, the chances of their being punished in a weak legal system are low and indirectly encourage the destruction of the natural resource base and creation of a fertile ground for an atmosphere of non-observance (Park, 2011). Equally important is the penalty structure and the severity of penalties as a preventive mechanism in a country. Hence, the rule of law depicts how strong a country's legal framework is in terms of natural resource access, use and management. Following this line of thinking, it is to be expected that the less rule of law there is in a country, the more likely it is to have man-made disasters than in countries where the rule of law is observed more. Scientists have argued that the breakdown of the rule of law may be a direct result of the failure of the state due to the loss of its authority and the influence of law in society. This loss means that there will be nothing in place to control either individual or institutional behavior. Use of law may also be selective, with the political elite enjoying impunity.

State failure

According to Rotberg (2002), state failure may refer to several failures on the part of the state, such as the failure to control the means of violence, create peace or stability for their population, control their territories, or ensure economic growth or any reasonable distribution of social goods and services. State failure is also used of a government that has lost its legitimacy even while it continues to perform its functions (Rotberg, 2002). The failure of the state is often characterized by massive economic inequalities, warlordism and violent competition for resources. State failure can be grouped into three categories: (1) a total collapse of state institutions, (2) weak states and (3) failing states. A total collapse of the state was seen in Somalia, the disintegration of the former Yugoslavia, and the various crises in Rwanda, Haiti, Liberia, Congo, Sierra Leone and Afghanistan (Prunier, 1997). A majority of 'weak' or 'failing' states have been identified in Sub-Saharan Africa, as well as a considerable number in central Asia and some parts of Latin America and South Asia (Rotberg, 2002).

1.3.2 Natural disasters

A natural disaster is a major adverse event resulting from natural processes of the earth that are beyond human control (Wisner *et al*., 1994). Natural disasters such as recurring droughts, floods, earthquakes, hurricanes, windstorms, heatwaves and other adverse weather events, wildfires and changes in rainfall patterns are increasing in number and intensity (FAO, 2017; Gähler, 2016; Sawada et al., 2011). Scientific studies seem to agree that human-made disasters, particularly burning fossil fuels, cutting down rainforests and raising livestock, are accelerating changes in climate (Calton, 2020; IPCC, 2012). These human activities are reported to be contributing enormous amounts of greenhouse gases compared to those released naturally into the atmosphere and therefore increasing the greenhouse effect and global warming (IPCC, 2019). For example, the frequency of droughts, especially mid-season dry spells, and a rise in temperatures that cause heatwaves and wildfires are on the rise in many parts of the world, including some parts of Sub-Saharan Africa (Makate *et al*., 2016). The increase in the frequency and severity of extreme weather patterns is not confined to Africa alone: for example, the increase in and worsening effects of tsunamis have hit countries like Japan, Hawaii, Myanmar and the United States, to mention just a few. The severity of the impact of such disasters also depends on a country's state of preparedness. Natural disasters threaten the local livelihoods of people located in marginal areas, particularly in coastal areas, arid and semi-arid regions, or agro-ecological regions that are naturally dry (Committee of Food Security, 2012a). For the purposes of this study, in the natural disaster category the focus is on droughts, floods and other adverse weather events in terms of

heatwaves and changes in rainfall patterns that have become common disasters in Africa over the past decade or so.

Droughts

Drought is a complex phenomenon that is defined in several different ways (WIREs Water, 2015; Lloyd-Hughes, 2014). Droughts have occurred in past centuries with spatial and temporary differences across the world, but in recent years their incidence and intensity have increased, prompting many scientists to examine the possible causes and impacts, particularly for farming communities. Drought tends to be defined differently by different researchers, mostly based on their research objective. This study adopts the definition proposed by Tallaksen and Van Lanen (2004), who defined drought as 'asustained period of below-normal water availability. It is a recurring and worldwide phenomenon, withspatial and temporal characteristics that vary significantly from one region to another'. A drought is characterized by a lack of precipitation in the form of rain, snow or sleet for an extended period of time, changes in actual and potential evapotranspiration, soil water deficits and reduced groundwateror reservoir levels (FAO, 2016; WIREs Water, 2015; Sivakumar *et al*., 2011). Droughts can be a result ofnot receiving adequate rain or snow over a given period due to global weather patterns, high pressure, tropical outlooks and other global-scale variables (WIRFs Water, 2015). While droughts are mostly regarded as a natural event, scientists have also found that human activities, such as drawing excessivewater during a normal rainfall season, may also lead to a drought in a bad season due to diminished water sources, particularly in naturally dry regions (IPCC, 2019; MacDonald *et al*., 2019). Manyscientists believe human activities are contributing immensely to the emission of greenhouse gases, which in turn causes abnormal elevations of global temperatures that directly contribute to dry conditions, drier weather and drought (AghaKouchak, 2016). Also, the earth's rising temperatures havebeen reported to be fueling longer and hotter heatwaves and more frequent droughts (Schiermeier, 2018). Scientists have used several terms to describe any precipitation deficit with terms such as agricultural, hydrological, meteorological and mega droughts (IPCC, 2012). Agricultural drought threatening the livelihoods of the majority of farmers in semi-arid regions refers to the shortage of precipitation during the farming season, which interrupts crop growth and production or ecosystem functioning in general due to soil moisture deficits, whereas hydrological drought is defined as a precipitation deficit during the run-off and percolation season that primarily affects water supplies (IPCC, 2019, WIREs Water, 2015). Meteorological drought refers to a period with an abnormal precipitation deficit, whereas mega-drought refers to a much lengthy, longer than normal and pervasive drought that usually lasts a decade or more (WIREs Water, 2015; IPCC, 2012).

Floods

Floods are a natural event where the overflow of an enormous quantity of water beyond its normal limits exceeding what is normal on dry land submerges land under water (Gornall *et al*., 2010). Floods can occur anywhere, including coastal areas and inland locations (Hunt, 2005). Floods are classified into five types, namely flash, river, coastal, storm surge and inland floods. The differences between these floods pertain to their locations and causes. For example, a flash flood is a result of heavy rainfall of between three to six hours; river flooding occurs when water levels rise over the top of river banks; and coastal flooding is the inundation of normally dry land areas along the coast with seawater due to tropical cyclones, tsunamis or higher than average tides (Nicholls *et al*., 2007). A storm surge is the result of an abnormal rise in water levels beyond the regular astronomical tide in coastal areas and is caused by wind, waves and/or low atmospheric pressure, whereas inland flooding occurs with steady rainfall over several days or is due to short but intense periods of rainfall also known as 'heavy downpours' (Norbiato *et al*., 2008). Inland flooding can also be caused by snowmelt, although rainfall is more the common cause. Some of the prominent causes of floods include heavy or excessive rainfall from tropical storm systems that make landfall, storm surges in coastal areas, persistent thunderstorms over the same area for extended periods, a combination of snowmelt and rainfall, and ice jam (Levinson and Waple, 2004). Research has also shown that human practices also add to the risk of flooding, for example, cutting down trees in large quantities, increases the levels of carbon dioxide released into the atmosphere that cause changes in climate and pose the threat of further natural

disasters like floods (WIREs Water, 2015). In addition to cutting down trees, scientists have shown that burning fossil fuels depletes the ozone layer and increases the level of greenhouse gases, these too being major causes of man-made flooding (Ahmad Khan, 2017).

1.3.3 Climate change

Climate refers to the existence of long-term weather conditions in a particular place or region over decades or longer (Brazier, 2015; IPCC, 2012). Weather refers to the state of the atmosphere in terms of, for example, precipitation, temperature, wind and extremes at a given time and place (Brazier, 2015). Several studies show that climate has always been changing, but it is reported to be changing at a much faster pace now than it was centuries ago (Brazier, 2015; IPCC, 2012). This faster change in climate is what is referred to as climate change, or changes in weather patterns that include changes in land surfaces, ice sheets and oceans (IPCC, 2014). Climate change therefore refers to a long-term change in a climate whereby greenhouse gases are trapped in the atmosphere, thereby altering the composition of the atmosphere and causing global warming (Brazier, 2015). There is consensus among scientists that human activities are quickening climate change through the burning of fossil fuels, cutting down trees, especially clearing forests and rainforests, using fertilizers and raising livestock (IPCC, 2019; Gähler, 2016).

Causes of climate change

Many scientists agree that global warming has been compounded by human activities that have increased greenhouse gases in the atmosphere, thereby heating the planet much more, leading to many other changes, such as the melting of ice and snow on mountains, including at the North and South Poles (Gähler, 2016; Brazier, 2015; Park, 2011; Sawada et al., 2011; Harding, 2009). The extra water from melting ice in turn causes a rise in sea levels, while ocean and wind currents are influenced by global warming, leading to changes in rainfall patterns and increases in extreme weather events such as droughts, fires, floods and storms (Brazier, 2015). Today, the whole world is experiencing disasters that have become more severe in recent decades, especially extreme weather events that threaten the local livelihoods particularly of poor communities living in semi-arid regions who mostly rely on agriculture (FAO, 2017; Gähler, 2016). Scientific evidence shows that in some regions extreme weather events and rainfall variability are becoming more common and are frequent leading to floods in some parts, while other parts are experiencing extreme heat waves and droughts (Brazier, 2015). Such extreme events are expected to intensify in the coming decades should the world continue to maintain a position of business as usual.

Climate-related disasters

In recent years, several climate-related disasters have been experienced across the world, including tropical cyclones, which cause heavy rainfall, often combined with thunderstorms, which sometimes lead to hailstorms, floods and flash flooding (Brazier, 2015). The term 'tropical cyclone' is generally used to describe a strong cyclonic-scale disturbance that originates over tropical oceans (IPCC, 2012), though it may also be called a hurricane, a typhoon or simply a cyclone, depending on geographical region. Also, over the years, climate-related droughts and related hazards have increased in numbers and intensity (Morton *et al*., 2017; Davis and Hirji, 2014). Although droughts are said to be a part of a natural cycle that is influenced by a climate pattern such as the El Niño-Southern Oscillation, which arises in the Pacific Ocean when the temperature rises, causing rainfall fluctuations across the southern hemisphere (Brazier, 2015), scientists argue that human activities are accelerating climate-related disasters.

2 STATE OF KNOWLEDGE ON CRISES AND FARMERS' RESPONSES

2.1 Manifestations of crisis from the farmers' perspective

Disasters, whether natural or human-induced, have many impacts (Gähler, 2016), for example, on social and physical circumstances, production, markets, support, climatic conditions and increased insecurity among affected communities (Figure 2). Below is an outline of the manifestations of crisis from farmers' perspectives.

Figure 2. Farmers' perspectives on the manifestations of the crisis

2.1.1 Support

A crisis often manifests itself through a decline in public service support by extension services being weakening and a reduction in the capacity of banks to continue to provide loans, especially to the rural poor (Kimenyi *et al*., 2014). Support or a lack of it may also manifest itself through the removal of subsidies on agricultural inputs, certainly making life difficult for poor households, though in difficult times even wealthy households may experience the same problems in buying costly inputs. This may be a direct result of the corruption of the political elite, as manifested through the embezzlement and misappropriation of public funds, thereby paralyzing the public sector (Olaosebikan, 2010). Besides corruption, the pervasive looting of mineral resources by political elites has debilitating effects on financial institutions, reducing financial support to poor farmers in a highly unequal equilibrium between the rich and the poor. Also, disasters may have the far-reaching effect of non-governmental organizations that normally cover the financing support gap left by the government being forced to withdraw to safe countries or regions, resulting at times in the breakdown of contracts and cooperation (Kimenyi *et al*., 2014). Lack of support may also manifest itself when foreign aid is cut, reduced or withdrawn, with a fall in foreign direct investment (FDI) and remittances (Franklin and Giovannetti, 2011).

In terms of minimum extension services, these can be manifested in the form of minimal government expenditure on research and extension services (Djurfeldt *et al*., 2005). When financial resources are tight, there is a tendency to cut down on certain areas, and public services often suffer. Low government support to extension means that farmers may receive minimum extension services, while for those in remote areas services might be irregular or completely absent. Another manifestation of minimum extension services by government agents is the outsourcing of such services by the better off for a fee, while the poor might revert to using indigenous knowledge systems involving trial and error through imitating others (FAO, 2005). Minimum or weak delivery of extension service can also manifest itself through the failure of otherwise excellent technologies to reach farmers (Djurfeldt *et al*., 2005; FAO, 2005). The efforts to interact with mostly poor rural farmers under severe weather and logistical conditions in order to influence their behavior positively are seriously hampered by crises.

Insecurity also affects the provision of public services such as financial support from banks, government and private companies, and extension services will be weakened (Kimani-Murage et al., 2014). Also, foreign aid may be seriously affected. This, coupled with the state's inability to implement efficient wage mechanisms, with civil servants receiving meagre salaries, leads to the latter often use

their position and power to seek rents in exchange for goods and services, particularly when the fines for doing so are not deterrent enough or when the chances of been caught and fired are low (Park, 2011). Insecurity also weakens legal and institutional frameworks, often resulting in the breakdown of the rule of law, increased corruption and an increase in conflicts over land. Studies have shown that public servants in more corrupt-prone countries often try to find alternative but illegal sources of income, particularly when their salaries are not high enough, perhaps forcing them to take bribes from criminals, thereby rendering rules and regulations ineffective (Park, 2011). The government's lack of resources to provide decent salaries to public servants in many countries compromises and significantly jeopardizes rule enforcement, the management of natural resources and the country's safety performance, as bribes may be accepted in exchange for lenient applications of safety rules and regulations, as in the use of mercury to separate gold from ore in illegal mining. It is to be expected that the higher the level of corruption in a country, the more likely it is to have more man-made disasters than countries with lower levels of corruption.

2.1.2 Natural base

The consequences of human-made and natural disasters are already being experienced across the globe, with evidence of more extreme heatwaves and temperatures worsening drought conditions in many parts of the world (Sutanto *et al*., 2020; Schiermeier, 2018). The available scientific evidence shows that climate change has been increasing the dryness of some regions that have been characterized by dryness for decades, although there is also scientific evidence using computer simulations of possible abrupt changes to heavy seasonal rainfall in the Sahel, a naturally dry area (Schewe and Levermann, 2017). Extensive studies also indicate increases in the incidence, intensity and degree of extreme climatic events in different parts of the world (Westerling, 2016; Handmer et al., 2012). Such extreme climatic conditions have expanded the areas under dry climatic conditions (Braizer, 2017). This is compounded by the further increase in temperatures, which is currently estimated at between 0.2 and 0.8^0C, but which when projected will see a further increase of between 3.0 and 4.0^0C, making dry areas drier (Sarr, 2012). This is compounded by rainfall unpredictability more specifically relating to late onset, early cessation rainfall, as well as the reduction in growing length periods (GLP), which negatively affects local agriculture, particularly in semi-arid regions (Sarr, 2012). These climatic conditions, apart from posing a great risk to human life, threaten local livelihoods by destroying plants and animals, thus reducing biodiversity and causing crop failures.

These environmental conditions compel rural farmers in semi-arid regions to respond in a variety of ways using different land-use systems, which in turn affects vegetation cover and soil moisture (Douville, 2002). Losses of vegetation cover often results in soil erosion, further worsening already inherently infertile soils and greatly affecting the agricultural production of many poor households in semi-arid regions.

2.1.3 Market

Violent conflicts may also disrupt the delivery of public goods and services by reducing extension services and financial support, thus bringing about the breakdown of markets (Harding, 2007). Basic infrastructure services may also be neglected, causing transportation costs to increase beyond the ability of poor farmers to pay them, particularly for those living in remote areas (FAO, 2015). In situations like these, farmers often take fright at price falls and plant less, use fewer inputs or even skip some costly inputs entirely, as they find financial support difficult to access (Hazell *et al*., 2007). The forces of disasters are expected to push input and output prices high: for example, market prices for cereals may rise beyond the reach of many poor rural households, as was witnessed during the 2008 global financial crisis, when cereal prices shot up by 20% to 40% in real terms compared to whatthey had been in the early 2000s (Botzen *et al*., 2019). In difficult situations, cereal prices may sharply increase following excessive government reactions either restricting the export of grains or the restocking of an already constricted inventory in a rising market (Wiggins *et al*., 2010). Price spikes often result from unusual combinations of events, such as a loss of harvests, a rise in input costs, a drop in output prices or contracts and cooperation breaking down (Okuyama and Santos, 2013).

Also, shocks from multiple disasters and the economic downturn may lead to reduced demand for agricultural commodities, especially those that may be regarded as 'luxury' foods, for example, meat and dairy products (Hazell et al., 2007). Similarly, the demand for industrial products such as cotton, tobacco and rubber may fall or the demand might even stop entirely for certain products during crisis periods. At the same time, disasters may also cause a reduction in financial flows, reducing banking capital, foreign direct investment and remittances, which might have short- and medium-term negative impacts, resulting in the breakdown of contracts and cooperation (Sirkeci *et al*., 2012).

2.1.4 Production

Human-made disasters can create serious disruptions to the agricultural economy, resulting in low productivity, which in turn increases food insecurity among poor households. Many severe drought events have occurred in recent years with devastating impacts on the livelihoods of poor rural farmers, as this directly affects production by reducing harvests and plant growth and increasing animal mortality, in turn creating food insecurity among poor households in drought-affected areas (WIRFs Water, 2015). Diminishing water levels make it impossible even to irrigate crops, as rivers, streams and other water reservoirs, including groundwater, dwindle whenever there is a drought (Sivakumar *et al*., 2011). Reductions in production most often negatively affect markets through the breakdown of contracts and cooperation with private companies, at the same time drastically reducing the raw materials used by agro-industries and thus the GDP particularly of nations where the mainstay of the economy is agriculture (Wilkinson and Rocha, 2008). Droughts perpetuate poverty, as during them food prices go up, but the majority of poor households cannot afford to buy food on the market, causing them to try to find other means of survival. As water supplies diminish in drought-affected areas, serious drinking water shortages arise for both humans and animals (Carlow *et al*., 2010). At the same time, the droughts that happen in naturally dry areas may cause land, forest and soil degradation (IPCC, 2019). In drylands, land degradation often involves soil degradation and erosion, which can be made worse when people remove protective vegetation by clearing forests, practicing slash and burn agriculture, overgraze and plough the land (UNEP, 2015; Nachtergaele et al., 2011a; de Ploey et al., 1991). In cases of prolonged drought, drought-affected people may migrate in search of better habitable environments, which often creates competition over resources such as land, water and forests, resulting in conflicts over land (Burrows and Kinney, 2016; Hoffman and Grigeria, 2013).

Droughts occur everywhere around the world in both semi-arid and in wet and cold regions (WIRFs Water, 2015). Severe drought events have occurred across the globe in recent years, for example, the 2014 winter drought in Scandinavia, which caused severe wildfires, while in 2013 drought events hit Brazil, Namibia, Angola, central Europe and New Zealand (WIRFs Water, 2015). In 2015 the worst water shortage in California is believed to have been intensified by global warming (Diffenbaugh *et al*., 2015). The more than decade long drought (1997-2009 Millennium Droughts) in Australia resulted in a widespread water-supply crisis across the country (Heberger, 2012). In 2006, China's Sichuan Province recorded the worst drought in modern times, which caused severe water shortages (Wang *et al*, 2011). Western Europe experienced the worst water shortages in the spring of 2011 (WIRFs Water, 2015). In 2015 and 2018, Cape Town, South Africa, had severe droughts resulting in water crises (Sousa *et al*., 2018). Decades of droughts fueled the Darfur conflict in Sudan, which also affected neighboring Chad. In 2005 the Amazon basin was hit by the worst drought, identified as a one in every century events, although the 2010 drought was also extreme, resulting in major rivers recording low levels in the Amazon region and causing several forest fires (Davidson *et al*., 201). Also, East Africa has experienced recurring droughts (Haile *et al*., 2019). In 2004 and 2007, Kenya experienced droughts lading to increases in temporary migration and decreasing soil quality (Gray, 2011). In the Western Sahel from 2005 to the present, drought and water scarcity have been the major drivers of migration and violent clashes between pastoralists and farmers over resources (Benjaminsen *et al*., 2012). Also, droughts in Syria in 2006 and 2014 saw increases in rural-urban migration and violent conflicts (Abel *et al*., 2018). From 1991 to the present, droughts in Peru and Bolivia experienced increases in labor-related migration by farmers due to devastating droughts which contribute to conflicts between farmers over

resources (Burrows and Kinney, 2016). This list of recent droughts is not exhaustive, but it is enough to demonstrate the recurring and worldwide nature of droughts. It is therefore one deciding factor for farmers, particularly those in semi-arid regions of Africa, regarding what and how much to grow, as well as which agricultural practices will help them harvest crops in the face of droughts and related hazards like heat waves and wildfires.

Disasters have more than short-term impacts on agriculture. The sector often endures long-lasting and multi-pronged consequences, such as losses of harvests and livestock, outbreaks of diseases, and the destruction of rural infrastructure and irrigation systems (FAO, 2017).

2.1.5 Social

For farming communities, the impacts of wars and ***political violence*** are broad and can be both direct and indirect. The social impacts of human-made and natural disasters are many and refer to changes that may push individuals, groups, communities or a whole nation into severe pressure, leading to a weakening of social organization, mutilation, a loss of life and disruption to families (FAO, 2017). Wars and political violence cause losses of human lives, but apart from death and/or mutilation, disasters also disrupt social and economic networks and activities, thereby weakening social organization. The weakening of social organization results in people becoming more individualistic and unwilling to cooperate with others. It is hypothesized that the more individualistic a community, region or nation becomes, the more likely it will have more human-made disasters than those with collective structures and tendencies. Research has shown that members of a collective culture choose to cooperate more frequently than those operating individually (Park, 2011). Families are disrupted through migration in search of greener pastures or more habitable places, thus separating families, as not all their members can migrate. Settling in new areas through land-reform programs sometimes separates families, with the person allocated land having to leave some family members behind, depending on the specifications of the redistribution program. A crisis sometimes manifests itself through the emergence of conflicts over land and access to land by landless citizens, land use when tenure systems are not secure, boundaries, grazing areas and over other livelihood resources, such as water and forests (Mutondi, 2010; Moyo, 2011).

2.1.6 Physical

Floods can have devastating consequences on communities that depend on agriculture, as they threaten local livelihoods by damaging infrastructure and the loss of physical property, such as roads, bridges, farms and houses (Sarr, 2011, FAO, 2001). Production can equally be affected, resulting in the loss of produce, plants, harvests, animals and human life (FAO, 2017). The loss of production threatens the availability of food, usually the poor being the hardest hit. The price of food often goes up in difficult situations like these, plunging the poor into poverty and hunger (Sasson, 2012; Narayan *et al*., 2000). The damage to road networks and bridges may present challenges in mobilizing support to affected communities (Forman and Alexander, 1998). Flooding may also cause a loss of drinking water, including severe contamination of water supplies, which in turn increases the risk of waterborne diseases. When flooding happens, farmland is usually inundated with floodwater, making the land unworkable and preventing crops from being planted or harvested, and thus causing serious crop losses that can lead to food shortages for both people and livestock (FAO, 2001). Entire harvests can be lost in extreme floods, and the root systems of some tree species may not survive extended flooding (Yu *et al*., 1969). Floods also have secondary and long-term effects, as well as benefits (Belay, 1991). The long-term effects of floods relate specifically to the economic hardships a community or nation has to endure in terms of rebuilding costs and food shortages that often lead to increases in prices (McMichael, 2009). In situations where affected communities suffer serious damage, deaths, serious injuries and loss of property may cause psychological damage or stress (Walsh, 2007). Conversely, smaller floods repeated regularly may also bring some benefits, such as recharging groundwater, in turn providing much-needed water resources, particularly in arid and semi-arid regions, where precipitation can be very unevenly distributed throughout the year (Kundzewicz *et al*., 2012). Others argue that fresh floods play an important role in preserving ecosystems in river passages and can be

an important factor in maintaining floodplain biodiversity (Arthingto et al., 2009). In Africa, several countries experienced flooding to varying degrees in 2018, for example, the Rwanda floods, which caused major landslides destroying over 10,000 houses and leaving about 200 people dead (Hallegatte *et al*., 2018). Also, in the same year, floods in Kenya killed at least 186 people due to mudslides, the collapse of buildings and capsizes (UNDRO, 1985).

2.2 Farmers' responses to the crisis

In times of crisis, farmers may consider alternative production systems that minimize costs based on the rationale that the resources and inputs available to the farm are used at the same time, making efforts to reduce or even skip costly inputs acquired externally (Rudel, 2009). Similarly, farmers make decisions on how to reduce the risks and uncertainties of price shocks, as well as outbreaks of pests and diseases through diversification (Monjane, 2018). This diversification might include the adoption of different complementary activities that help reduce unit costs, increase resilience and improve food security. Tracking the history of household resilience to crises that often result in food insecurity, poor farm households exhibit fairly regular behavioral responses in the form of coping strategies (Maxwell, 1996) or techniques that households generally adopt to cope with crises, particularly in the scarcity or absence of resources (Maxwell *et al.*, 2008). Such strategies can be differentiated as on-farm and non-farm-based techniques (Fig. 2) (Danso-Abbeam *et al*., 2018). They were commonly observed among farmers in vulnerable contexts which often involve natural calamities and the economic and political crises that reduce productivity and increase food insecurity among poor rural households (Baro and Deubel, 2006). In the early stages of crises, households may adopt various coping strategies (Goldstein and Frankenberger, 1990), depending on cultural and geographical differences (Maxwell et al., 2008).

There is a wide range of responses that farmers adopt in bad times, which can be grouped into the two categories of on-farm and off-farm activities (Table 2), but there are also the short-term reactions that are a characteristic of farmers' immediate reactions when they are confronted with severe crises. These three categories are discussed below in respect of the short- and long-term strategies that farmers adopt in response to crises.

Empirical evidence shows that households modify their productive decisions to reduce losses or risks, for example, reduce or change livestock type (Monjane, 2018; Verpoorten, 2009), skip costly inputs by concentrating and intensifying available resources on the most suitable land, and integrating crops and livestock where they can raise cash through the sale of livestock and fertilize their fields with livestock manure (Xu *et al*., 2009). Livestock can easily be sold and thus provide the income households need in times of crisis.

Others make decisions by shifting income sources to protect consumption, for example, by shifting back to subsistence activities while reducing their participation in market activities. A study by Bozzoli and Brück (2009) shows that weak labor markets also intensify the protective behavior of consumption and income due to the limited opportunities for off-farm work. However, in some cases the crisis may increase start-ups of non-agricultural activities, as Deininger found in Uganda (2003). The crisis may also induce adjustments to investment decisions when households save food and whatever money they may have as the future becomes increasingly uncertain (Verpoorten, 2009).

To a large extent, farmers have been able to devise risk- and cost-minimizing strategies that enable them to constantly cope with and adapt to adverse weather conditions, severe pest and disease attacks, price fluctuations and ever-changing policies locally, nationally and globally (Mertz et al., 2009). In an attempt to cope with this situation, farmers respond to crises in several ways. In general terms, they pragmatically combine a range of on-farm and off-farm activities (Mathenge and Smale, 2013; Haggblade *et al*., 2010) with different degrees of success and scope of effects (Quinn et al. 2011). Their specific responses and their effects depend on socio-economic, agro-ecological and market conditions (Murendo *et al*., 2016), as well as their own skills, capacities and assets (Bingen *et al*., 2003).

Table 2. Categories of farmer's responses to the crisis

Categories	Time horizon	Authors
Immediate reactions		
Food security strategies	Short-term	FAO, 2010; Brüntrup and Heidhues, 2002; Rakotobe et al., 2016; Gwenje et al., 2015
Finance coping strategies	Medium-term	Aizenman and Pinto, 2005
Strategic responses		
On-farm responses		Wondimagegnhu et al., 2016
Subsistence farming	Short-term	Brüntrup and Heidhues, 2002; Baiphethi and Jacobs, 2009; Appiah et al., 2007
Reduction, concentration and intensification	Long-term	Mortimore and Adams, 2001; Maiyaki, 2010; Adger 2006; Coulibaly et al., 2015; Wondimagegnhu et al., 2016; Rudel et al. 2009; Gardner and Davidson, 2011; FAO, 2012; Belay et al., 2017; Rusinamhodzi et al., 2013; Ausubel and Waggoner, 2008; Borlaug, 2007; World Bank, 2008
Diversification of production	Long-term	Wondimagegnhu et al., 2016; Kassam et al., 2016; Chambati, 2013; Sprent et al. 2010; Chibarabada et al., 2017; Schnofeldt and Hall, 2012; Stagnari et al., 2017; Murendo et al., 2016; Manda et al. 2016; Teklewold et al., 2013; Mashapa et al., 2013; The Montpellier Panel, 2013; FAO, 2015; Asfaw et al., 2019; Di Falco and Veronesi, 2013; Belay et al., 2017; Meijer et al., 2015; Osei, 1996; Nyamadzawo et al., 2013; Mutenge et al., 2010; Reardon and Taylor, 1996; Hassan and Nhemachena, 2007, 2008; Hagglabe et al., 2007; Larsson, 2005; Di Falco and Chavas, 2009; Baethgen et al., 2003; Brooks and Adger, 2004; Monjone, 2018; Bradshaw et al., 2004; Swinton, 1988).
Market-orientation	Long-term	FAO, 2013; Winters et al., 2009; Omiti et al., 2007; Makoka, 2009; FAO, 2017; Davis, 2006; Ismail et al., 2015; Sigei et al., 2014; FAO, 2010; UNDP, 2016; McCulloch & Ota, 2002; Minot & Ngigi, 2003; FAO, 2009, 2006; Heri, 2000; Bellemare and Barret, 2006; Hlongwane et al., 2014; Ohen et al. (2014)
Livestock production	Long-term	Bras and Solo, 2014; Xu et al., 2010; FAO, 2019; 2016; 2009; Monjane, 2018; FAO, 2009; Jitsanguan, 2001; Hassan and Nhemachena, 2008; Allen, 2006
Off-farm responses		Haggblade et al., 2010; World Bank, 2008
Diversification through jobs, migration and remittances	Short-medium and long-term	Hazell and Reardon, 2007; Gwenje et al., 2015; Dekker and Kinsey, 2011; Haggblade et al., 2010; Jacoby and Skoufias, 1997; Tevera and Chikanda, 2009; World Bank, 2008; FAO, 2015; Dekker, 2009; Schaar, 2013; Mohapatra et al., 2012; FAO, 2010, Adger et al., 2002; Scoones, 1998; Anriquez and Bonomi, 2007; Lohmar, Rozelle and Zhau, 2001; Djurfeldt, 2015; Ellis, 2000a; Djurfeldt, 2012; Alobo Loison, 2015; Barret and Carter, 2013; World Bank, 2008; de Brauw and Giles, 2008; de Haas, 2009; de Janvry et al., 2006; Frankenberg et al., 2003; Dekker, 2009; Gwenje et al., 2015
Diversification through exploitation	Short-term	Campbell and Trechter 1982; Campbell et al., 2001; Quinn et al., 2011; Adger et al. 2002; FAO, 2011; Neumann, 1997; Wehrmann, 2008; Goetz et al. 2001; FAO, 2016; Verhoeven and Setter, 2010; Njenga et al., 2017; Zulu, 2010

Several pieces of literature on farmers' strategies focus on climate change (Asfaw *et al*., 2019; Monjane, 2018; Makate *et al*., 2016; Di Falco and Veronesi, 2013; Hassan and Nhemachena 2007; 2008), but very few on multiple stressors. Changes in climatic conditions are one key factor influencing farmers' coping and adaptation strategies to environmental change (Eakin and Luers, 2006; Adger, 1999), being especially pronounced among the poor and vulnerable in African dryland regions (Ziervogel *et al*., 2006). However, preferred strategies also depend on several other key factors, such as the availability of information and support, and socio-economic status, any of which may act as a hindrance to or enabler of effective implementation of one's preferred livelihood strategies. Empirical evidence shows how people living in drylands adjust their livelihood strategies, with some innovative farmers and communities even managing to improve on traditional practices to develop different coping strategies that enable them to survive the many stressors (Scoones, 1994; Mazzucato and Niemeijer, 2000). Some studies describe the many strategies farmers adopt in their efforts to minimize risks and costs (FAO, 2010; Monjane, 2018; Asfaw *et al*., 2019; Mortimore and Adams, 2001). The various strategies can be grouped into two categories, namely on-farm and off-farm strategies. The effectiveness of these strategies depends largely on the household's members' coping and adaptive capacities, which may vary from region to region (Jones *et al*., 2010).

2.2.1 Immediate reactions

2.2.1.1 Food compromising strategies

Several studies show how farmers sometimes cope with situations that challenge the availability of food where they immediately react by rationing the available food through cutting down the number of meals they take per day or giving the adults less and the children more (FAO, 2010). Using the same logical thinking, others may respond by consuming low-quality food, or fewer food items (Brüntrup and Heidhues, 2002). Borrowing from relatives and or neighbors is often used on a short-term basis, but without other options the household will depend on food aid through government handouts or humanitarian organizations in response to an appeal being launched by the government or where production in marginal areas is very low and the population depends greatly on food aid (Rakotobe et al., 2016; Gwenje et al., 2015). Another strategy used in extreme conditions is simply to dispose of farm assets like livestock (Rakotobe et al., 2016).

2.2.1.2 Finance coping strategies

In severe crises, farmers first consider coping with risks by using the available assets, which may be too risky since most rural households have very limited options, their asset portfolios being highly restricted (Aizenman and Pinto, 2005). The most common short-term response by most households is to dispose of whatever assets they have, but as others are making the same decisions, disposing of the asset produces only a low return due to increased competition, and buyers often manipulate the seller's desperation by offering a very low payment. This is entirely the case with the price of large species of livestock like cattle, which normally form a sizeable component of a poor household's asset stock. However, when all households with cattle are selling their livestock in response to a decline in tobacco, cotton, coffee or maize prices, the price for livestock will automatically decline (Aizenman and Pinto, 2005). While livestock depletion is among the first reactions households take in bad times, it is not easy to liquidate such assets at a satisfactory price, as it may prove very difficult to find buyers, given that most other people will be equally affected. Moreover, restocking after the crisis might be very difficult, especially for poorer households.

2.2.2 Strategic responses

2.2.2.1 On-farm responses

Farm-led strategies are particularly important for agro-based economies in which agriculture is the main livelihood for the majority of the rural population. This is the case in most African countries, where most households are subsistence-oriented. Others are more market-oriented through the production of crops and livestock that can be sold in the market, while yet others diversify their production portfolios as a way to spread the risk (Wondimagegnhu *et al*., 2016). Five categories of on-farm strategies (consist of farming and agricultural production e.g., crop and livestock production, plantations etc.) were established, explained in detail below.

2.2.2.1.1 Subsistence-oriented production

Subsistence-oriented farming is a term often used synonymously with the concepts of small-scale, traditional, low-income, resource-poor, peasant, low-input and low-technology farming (Brüntrup and Heidhues, 2002). However, these terms have been used with different meanings in different disciplines, thus making it difficult to define subsistence farming. In general terms, subsistence farming involves making decisions to produce enough to satisfy the family's consumption needs, but at times these households may produce a surplus that can be sold to raise an income needed for other household requirements. Subsistence-oriented farming households are not a homogenous group; they can be classified under two sub-types, namely small subsistence-oriented family farms and small semi-subsistence-oriented or part-commercial family farms (Baiphethi and Jacobs, 2009). The first subtype comprises farm families that adopt few crop and livestock types, and who under extreme conditions may engage in the exploitation or management of local natural resources or practice shifting cultivation using slash-and-burn as an element of their farming cycle (Appiah *et al*., 2007). The majority of subsistence-oriented farmers cultivate a wide range of crops and raise different sorts of livestock,

thereby falling under the subtype of small semi-subsistence-oriented family farms. These are discussed below as the second subtype of subsistence farming.

Small semi-subsistence-oriented families work to produce food crops to achieve family sustenance, but they may also produce products and materials for use on the farm (e.g., growing gum trees for construction, particularly as a roofing material), as well as to generate a cash income for household requirements that cannot be produced on the farm. Examples of household requirements bought using cash raised from selling surplus commodities include items like salt, sugar, clothing, medicines, farm inputs and children's school fees (Mashindano *et al*., 2011). Some families may decide to grow cash crops on a small scale from which they earn the cash needed for household requirements. Manystudies view subsistence-oriented farming in very negative terms, seeing it as backward, inefficient and a drag on economic grow and performance (Brüntrup and Heidhues, 2002). However, this study argues that subsistence farming is the most logical option for poor people to survive under extreme conditions of limited inputs, outputs, and credit and extension services, coupled with price shocks, risks and uncertainty.

2.2.2.1.2 Reduction, concentration and intensification of production

African rural households are faced with many challenges, but they have always had to manage their resources and livelihoods in the face of challenging environmental and socio-economic conditions (Mortimore and Adams, 2001). Multiple crises induced by adverse political, economic and environmental dynamics may compel farmers to adjust and modify their behavior (Maiyaki, 2010), particularly for highly vulnerable poor farmers located in the rural tropics (FAO, 2010a). Situations of crisis easily worsen the often already difficult conditions under which asset-poor farmers must produce (Adger 2006). Low commodity prices may fall even further (Coulibaly *et al*., 2015), costly agricultural inputs become unaffordable and land insecurity may increase, as may the probability of crop and livestock diseases breaking out (Wondimagegnhu *et al*., 2016). Nonetheless, several studies also highlight the ability of poor farmers to opt for less destructive strategies. For example, farmers in semi-arid contexts in particular may respond to crises with an immediate reduction of costly inputs, often involving the concentration of available assets on the most suitable pieces of land (Rudel et al. 2009) in terms of soil fertility, accessibility and moisture content (Gardner and Davidson, 2011). This concentration process is often accompanied by a re-orientation towards the production of food for their own consumption (FAO, 2012). Accordingly, such intensively managed areas deliberately integrate crops and livestock (Belay *et al*., 2017). This intensification can result in a considerable increase in productivity (Rudel *et al*., 2009; Rusinamhodzi *et al*., 2013) overall, especially if combined with investments in irrigation (Belay *et al*., 2017). In parallel to this, the agricultural concentration may create larger tracts of fallow land that, as well as permitting highly demanded land uses such as grazing paddocks and or woodlots, provide enhanced environmental services (Ausubel and Waggoner, 2008; Borlaug, 2007). Other farmers may decide to produce for home consumption, a response commonly is referred to as subsistence-oriented farming, but they may also engage in markets for one reason or another, such as obtaining food, labor, etc. in a more limited way than others (World Bank, 2008).

2.2.2.1.3 Diversification of production

Another risk-reducing strategy reported among African farmers is the diversification of their product portfolio to include more staple crops (e.g., maize, wheat, sorghum and millet), different pulses (e.g., beans, groundnuts and cowpeas), roots and tuber crops (e.g., sweet potatoes, potatoes, yams and carrots) and other vegetables like tomatoes, onions, cabbage and kale (Wondimagegnhu *et al*., 2016; Chambati, 2013). Additionally, they may grow fruits (e.g., mango, avocado, peaches, bananas, papayas, oranges, lemons and guava), oilseeds (soybeans and sunflowers) and cash crops (cotton, tobacco, coffee, tea and sugarcane). Such diversification may enhance their food security, as well as contribute to the environmental stability of the production system (Kassam *et al*., 2016). Particularly the additional cultivation of leguminous crops due to their ability to fix nitrogen (Sprent *et al*. 2010) and high protein content (Chibarabada *et al*., 2017) can be beneficial, particularly for poor households cultivating small patches of land with limited soil fertility (Schnofeldt and Hall, 2012; Stagnari *et al*.,

2017). A number of studies (Murendo *et al*., 2016; see Manda *et al*. 2016; Teklewold *et al*., 2013; Mashapa *et al*., 2013; The Montpellier Panel, 2013) reported that external threats stimulated small-scale farmers to adopt practices such as legume intercropping, legume crop rotations and the growing of legume tree species. In so doing, they diversify their crops as a risk management strategy in order to stabilize their incomes, which in turn helps them minimize their exposure to risks such as price hikes (FAO, 2015). Even among those who decide to specialize in, say, cash crop production, the tendency is to grow a variety of food crops as well, as a way of spreading the risk. A study in Bolivia describes the diversification practices of smallholders who cultivate more than thirteen different crops in farms of an average size of 0.89 hectares (Asfaw *et al*., 2019). This is similar to findings in Sub-Saharan Africa, where the dominant maize crop is grown together with sorghum, millet, cassava and potatoes, as well as beans and vegetables (FAO, 2015).

As more farmers living in semi-arid regions face a warm production environment, growing a variety of crops on the same plot usually intercropped or on different plots helps reduce the risk of complete failure because different crops are affected differently by climate events (Di Falco and Veronesi, 2013). Additionally, farmers employ strategic responses such as planting improved crops and drought-tolerant crop varieties, integrated pest management, exploiting agroforestry systems and using animal manure. Often, such practices go hand in hand with crop diversification, for example, when early-maturing crop varieties are combined with crop residue management as emergency feed for livestock in dry periods (Belay *et al*., 2017) or are used as mulch (Mashapa *et al*., 2013). Likewise, the adoption of agroforestry systems can improve the rain-use efficiency and soil conservation of rain-fed agriculture, with potential benefits for farmers and the environment (Meijer *et al*., 2015). Most importantly, such practices may help to avoid dependence on irrigation systems and fertilizer subsidies from the government (Osei, 1996)

However, in some cases farmers also use diversification strategies to modify the length of the growing season, for example, by using additional irrigation (Di Falco and Veronesi, 2013), using in-field water-harvesting and conservation techniques (Nyamadzawo *et al*., 2013) or mulching with fertilizer trees, legumes or crop residues (Meijer et al., 2015; Mashapa *et al*., 2013). Crop diversification is not only used to manage risk but also to cope with economic shocks and market uncertainties (Mutenge *et al*., 2010). In this way, farmers regard diversification strategies as safety nets that provide them with alternative livelihood options in contexts of extreme events (Reardon and Taylor, 1996). This is particularly the case for poor households with the least capacity and a lack of other alternatives to cope effectively with the crisis. Hence diversification is often one of the few viable options available for managing the manifold challenges they face (Asfaw *et al*., 2019; Hassan and Nhemachena, 2007, 2008).

Diversification pathways vary across countries and strategies in accordance with several factors, such as the availability of and accessibility to major markets, infrastructure and access to information. Also, while richer householders located in regions with favorable agricultural conditions may engage in crop diversification in order to raise an income (Hagglabe *et al*., 2007), poor households without the necessary assets are often pushed to seek food or income using alternative risky activities (Larsson, 2005). For example, the availability of cash-crop markets usually attracts the better-off households into crop diversification pathways that increase productivity gains, which in turn pushes them from subsistence farming to more trade-based agriculture, with gains for both net incomes and welfare (Di Falco and Chavas, 2009). This works particularly well for farmers who have access to both input and output markets, as they can take advantage of market opportunities to increase productivity and earn an income, and can even diversify into producing a greater range of products for the market (Hassan and Nhemachena, 2007). Moreover, those with relative access to information can make comparisons among alternative crop management that allow them to cope effectively with the crisis (Baethgen *et al*., 2003) and can choose a diversification strategy that helps them minimize their risks and costs (Brooks and Adger, 2004). Loss or risk management may include changes in planting and harvesting dates, mixing less productive drought-tolerant varieties with higher-yield water-sensitive crops, or

crop-livestock integration (Monjone, 2018; Bradshaw *et al*., 2004; Swinton, 1988). The expectation is that farm households near markets and with access to information will be able to take advantage of market opportunities to increase productivity and income portfolios. It is also expected that, for farmers living in remote, marginal areas with poor infrastructure and who lack access to information, diversification will be a survival strategy or a way of coping with risk.

2.2.2.1.4 Market-oriented production

Market-oriented farming occurs when a farmer decides to produce for profit. Here the farmer will produce crops and livestock for sale on the market (FAO, 2013). Among the many livelihood strategies rural households adopt is market-orientation, through which households derive most of their income from actively engaging in agricultural markets (World Bank, 2008). Distance to a market plays a key role in deciding whether or not to produce for profit, but in any case, access to markets is likely to increase opportunities in both agricultural and non-agricultural activities (Winters *et al*., 2009). Several studies' findings on market-oriented farming show that in most rural areas lower levels of output are sold and fewer farmers participate in markets compared to farmers who are located close to markets (Omiti *et al*., 2007). Despite the many benefits that come from market-oriented farming, for many villages market participation is hampered by high transportation costs, the high cost of often poor-quality inputs, high market charges and unreliable market information (Makoka, 2009; Omiti *et al*., 2007). In practice, several factors influence farmers' decisions to produce for the market, such as the availability and cost of inputs, market information, the quantity and quality output, producer prices, distance to the market and gender dynamics (Omiti *et al*., 2007). Gender dynamics are mostly evident in women's access to and control of resources, gender roles, and their participation in decision-making, rural institutions and development planning, all of which are normally heavily dominated by men because of the influence of patriarchal systems, cultural norms and tradition (FAO, 2017). As such, very few women participate in markets compared to their male counterparts.

The purchasing power for food and other household requirements is enhanced through market-orientation, as well as replacing household incomes with other activities such as off-farm enterprises (Davis, 2006). Also, the availability of niche markets for differentiated products such as cotton, tobacco, cocoa, horticultural produce and many others, often supported by private companies, has enabled some small-scale farmers to maintain market links and earn better incomes. Some farmers even produce for local markets when they sign contracts with village-level institutions like schools, hospitals, supermarkets and hotels for the direct supply of farm produce (Davis, 2006). In his study, Davis (2006) found that there is more market-oriented farming among farmers located close to urban centers compared to remote rural villages, and that the proportion of farmers who participate in the markets is lower than the actual output sold. However, the distance from farm to point of sale is a major constraint on the intensity of market participation (Ismail *et al*., 2015; Sigei *et al*., 2014). Unfavorable producer prices, limited market information and high transaction costs are key disincentives for increased sales (Ismail et al., 2015). Such results, which have been documented by many researchers, shed light on the urgent need to strengthen market information delivery systems, make improvements to road infrastructure, whether near to or far from markets, encourage market integration initiatives, and possibly establish retail outlets with improved market facilities in remote areas for the promotion of production and the trade in high-value commodities by rural farmers. Equally important is the dairy subsector, which contributes a significant share of income and food for the majority of small-scale farmers. If the whole value chain is strengthened, this can result in the dairy farmers making substantial profits (FAO, 2017; 2010; UNDP, 2016).

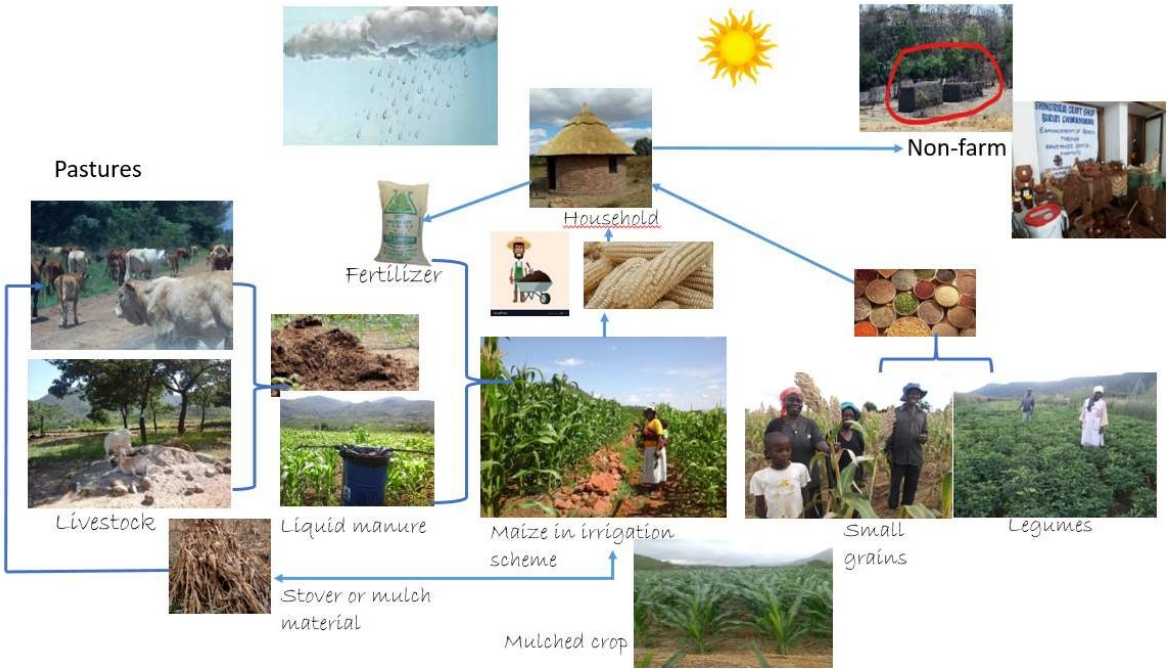
Another source of income and the link to markets that has largely grown over the past decade is horticulture (especially vegetables), which accounts for over 70% of Africa's total production (McCulloch & Ota, 2002). The popularity of horticulture is due to its higher returns compared to other cash crops and its suitability for production on smaller farm sizes in different agro-ecological regions (Minot & Ngigi, 2003). A variety of horticultural crops are grown by small-scale farmers for both subsistence and profit purposes, such as tomatoes, cucumbers, cabbages, kale and onions, as well as

roses and cut flowers (FAO, 2009, 2006; Heri, 2000). However, research on market participation is still limited, particularly in developing countries (Bellemare and Barret, 2006), as is also confirmed by Hlongwane *et al*. (2014) and Ohen *et al*. (2014), who identified some gaps in the literature on market participation with particular reference to factors influencing the process.

2.2.2.1.5 Livestock production

Raising livestock can be divided into large or small, with cattle or dairy cows counting as large livestock, while the raising of goats, sheep and chickens is often referred to as small livestock production. Usually, livestock production is combined with crop production, giving rise to the concept of crop-livestock integration. Nomadic herders, however, often specialize in livestock production and often lack a fixed abode, as they move where the pastures are to be found. The majority of rural farmers often integrate crops and livestock, with major benefits in doing so. Crop-livestock integration is not a new concept, as rural farmers have always kept livestock and combined it with crop production (Bras and Solo, 2014; Xu *et al*., 2010). However, the past decade has seen an increase in the importance and rearing of rural livestock for rural livelihoods and food security in the provision of meat, milk, eggs, hides and skins, draught power and manure (FAO, 2019; 2016; 2009). Livestock act as a strategic household investment, particularly in difficult situations, when small livestock may be viewed as an important safety net against adverse weather conditions such as drought. Small livestock are seen to be drought-tolerant, and can easily be sold for cash when the need arises (Monjane, 2018). Crop-livestock integration (Figure 3) takes into consideration the maximization of benefits in both non-monetary and monetary terms, such as improved household food security, quality of life and environmental conservation (FAO, 2009). This production system is a good example of sustainable agricultural production, as it involves the efficient use of scarce resources (both inputs and farmland) to increase the range of farm activities and thus help reducing risk (Jitsanguan, 2001). Livestock farming is a complex agricultural practice which requires great knowledge and skills, but across the world it has developed very different kinds of livestock-rearing systems, depending on agro-ecological conditions, cultural and religious beliefs and the economic and political environment (FAO, 2016). In Africa, mixing livestock with crops is nothing new and is by far the most common practice, whether with irrigation or in dryland farming (Hassan and Nhemachena, 2008).

Figure 3. Crop-livestock integration



Livestock provides farmers with a cash income which is used to grow food crops for home consumption, the residue being used as stock feed for livestock (Fig. 4) and to provide draught power,

organic and inexpensive animal manure for crop production (Xu *et al*., 2010). As such, integrated crop-livestock production systems are believed to be more sustainable than highly specialized production systems, particularly in the face of changing rainfall patterns (FAO, 2019; 2016), but the benefits of this system depend on their relationship to each other based on experience over time and space at the landscape level (Allen, 2006). When well-managed, integrated crop-livestock production systems can increase the productivity and effectiveness of agricultural systems, which in turn helps to improve the welfare of agricultural households.

2.2.3 Non-farm responses

Many studies show that non-farm incomes account for 35% to 50% of rural households' incomes across the developing world (Haggblade *et al*., 2010). Rural non-farm activities have attracted a lot of attention in recent years, given their importance for rural livelihoods in the context of rural people struggling with increasing numbers of marginal farmers and decreasing agricultural productivity, as the non-farm economy is viewed as offering a potential pathway out of poverty for many poor farmers (Haggblade *et al*., 2010). However, income varies with the different strategies households engage in, and many fail to improve their situations over time, which reflects the heterogeneity in each of the activities farmers adopt (World Bank, 2008). Non-farm activities are those activities that do not include farming as a source of income e.g., handicrafts, small-scale manufacturing, construction, mining etc. The several non-farm economic activities that rural farmers engage in can be put into three categories, namely diversification through wage employment or self-employment, migration and remittances, and over-exploitation of the available resources. These three categories are discussed in detail in the sections below, but first households often react to shocks in two distinct ways, namely food-compromising and finance-coping mechanisms, both usually short-term.

2.2.3.1 Diversification through jobs and remittances

Diversification into non-agricultural employment involves a complex decision taken at the individual household level after weighing the costs and benefits of the different available options and alternatives. Some households may diversify their activities by increasing the number of household members engaged in wage employment (Hazell and Reardon, 2007) or decide to engage in multiple economic activities other than the production of primary agricultural commodities (Haggblade *et al*., 2010). Among the economic activities farmers engage in are mining, construction, transport services, agro-processing like milling, packaging, bulking or transporting, petty commodity production (crafts) and trading, all of which are key components of rural self-employment strategies (Gwenje et al., 2015; Dekker and Kinsey, 2011; Haggblade *et al*., 2010). Wage incomes and self-employment include all cash and in-kind earnings, as well as non-durable, regular expenses for all non-farm activities on the part of any member of the household over twelve months (Jacoby and Skoufias, 1997). However, in difficult times, it is not easy to earn an income through self-employment, as buyers and people seeking services may decline. This limits the options for many rural households, which may resort instead to sending member(s) of the farmer's family to search for part-time work on other farms or rural non-farm employment (Gwenje *et al*., 2015; Haggblade *et al*., 2010, Tevera and Chikanda, 2009; World Bank, 2008). Depending on the severity of the crisis and its impact on the economy, this may result in reduced employment opportunities in the agricultural sector, which many authors have recorded as the highest employment giver for unskilled farm labor (FAO, 2015). Out of desperation, rural households have to find other options, and some may decide to diversify their income sources by looking for greener pastures outside their own country or even further away (Dekker, 2009). In the following section, I discusses diversification through migration and remittances in detail, as this provides an essential safety net for the remaining household members.

The decision to diversify one's sources of income contributes directly and indirectly to food availability (Jones et al., 2014). Also, to consider having a family member leave home in search of remunerative employment in urban areas or abroad is a common practice that is widely reported among rural farmers (Schaar, 2013; Hagglabe *et al*., 2010; Mohapatra *et al*., 2012; FAO, 2010, Adger *et al*., 2002; Scoones, 1998). The remaining members of the rural household benefit from migrant remittances,

though incomes from migrants depend on the success of the migrant. Migration is not available to all, mostly due to the high costs of migrating, which often prevent the poorest of the poor from migrating or limit their migration to nearby areas, usually with low returns (World Bank, 2008). Depending on the household's financial situation, they may decide to migrate to urban areas that are relatively close by, or even to neighboring villages or rural areas, but the better off may choose to migrate abroad or to urban centers (Anriquez and Bonomi, 2007; Lohmar, Rozelle and Zhau, 2001).

Empirical evidence abounds on the increase in the number of rural households that are sustained by multi-spatial livelihood activities (Djurfeldt, 2015; Ellis, 2000a), including food transfers (Djurfeldt, 2012). While income diversification is seen as one key alternative strategy in situations where there are no feasible opportunities to diversify one's sources of income, not all households have equal opportunities to earn a high return (Barret *et al*., 2001). Many, however, have limited opportunities to engage in remunerative non-farm employment (Reardon *et al*., 2008). The constraints and opportunities of rural households are unequally distributed both socially and geographically (Alobo Loison, 2015). Even in areas with favorable endowment opportunities, some households are better off in terms of assets, which enables them to access better opportunities, while others may get stuck relying on low-return activities and thus become trapped in structural poverty (Barret and Carter, 2013).

Also, non-farm local businesses and government services are not spared, and crises even tend to worsen the interest in hiring and paying for labor (Haggblade *et al*., 2010). As a result, in times of crisis young people particularly start to look for opportunities in urban centers and neighboring countries, or even further away (Dekker and Kinsey, 2011). In the event of disasters, resource-dependent communities depend even more on remittances from migrated family members (Adger *et al*., 2002; Scoones, 1998; Mohapatra *et al*., 2010), or money transfers or aid from development agencies and governments (Haggblade et al., 2010). In many parts of Africa, the proportion of remittances in rural households' *per capita* incomes has already reached an average of 9-13% (Du *et al*., 2005). In fact, remittances are considered the least volatile and most resilient form of financial support in developing countries (Schaar, 2013; Mohapatra *et al*., 2010), being responsible for the overall increase of 35% in rural incomes in Africa (FAO 2002). Doubtless this dynamic has strong social, cultural and economic effects on rural societies (Du et al., 2005). Migration strategies reduce the availability of agricultural labor (de Brauw and Giles, 2008), but where the migrant can send money back home, the evidence shows how the receiving households can invest it in land, livestock and human capital and use it for other household requirements. Remittances can also be used to offset income shocks, thereby protecting households' productive asset bases (World Bank, 2008). Several pieces of evidence show that remittances can lead to investments in productive activities and risk-coping (de Haas, 2009; de Janvry *et al*., 2006). At the same time, rural-to-urban migration demonstrates the role of agriculture as a safety net in times of crisis, characterized at times by reverse migration, which helps people deal with economic shocks. This happened in Indonesia and Thailand during the 1997 financial crisis, and return migration related to economic shocks has been reported in some parts of Africa (Frankenberg *et al*., 2003). However, depending on the intensity of the economic crisis, remittances from outside and inside a country may decline (Dekker, 2009). Acting in desperation, households may intensify their exploitative strategies by, for example, turning to mineral panning (Gwenje *et al*., 2015), dry-season gardening (Swinton, 1988) and many other destructive activities just to ensure their survival.

2.2.3.2 Diversification through exploitation

Confronted with a decline in agricultural production and market opportunities in times of crisis, farmers may also search for production and income-generating opportunities outside their farms. In such a situation, farmers may, for example, intensify the collection of wood and wild fruits from the surrounding forests, or start dry-season gardening along river banks (Campbell and Trechter 1982; Campbell *et al*., 2001; Quinn *et al*., 2011; Adger *et al*. 2002). Acting out of desperation, they tend to overexploit accessible resources (on- or off-farm), which may cause severe degradation (FAO, 2011;

Neumann, 1997). Ignorance of informal and formal land-tenure rights may also provoke severe conflicts with one's neighbors or the state authorities (Wehrmann, 2008; Goetz *et al*. 2001).

In general terms, it is hypothesized that crises tend to accelerate the tendency of poor households to employ environmentally destructive forms of land use and to overexploit easily accessible resources. Farmers first exploit the resources on their own properties, for example, by slaughtering livestock, felling trees or harvesting pre-mature crops, as well as by converting wetlands and forests into extensively used farmland (FAO, 2016; Verhoeven and Setter, 2010). Also, sourcing firewood from forests (Njenga et al., 2017) has significantly increased as an adaptation strategy compensating for the lack of electricity and the unreliable nature of the electricity supply in urban centers, which increases wood collection for sale to the many who depend on wood fuel (Zulu, 2010).

2.3 Theoretical foundation of farmers' decision-making

There is a broad range of literature on theories of decision-making by natural resource users (Meijer *et al*., 2015). Scholars are widely agreed that resource users fundamentally make rational decisions (Kleinschmidt *et al*., 2016). The most common approaches in the literature are the rational choice and behavioral economic theories, which have considerable similarities in their theoretical foundations and as such are both classified as neoclassical theories (Berg and Gigerenzer, 2010). The next sections present a brief review of the literature on and theories in rational choice and behavioral economics concerning small-scale farmer decision-making processes.

2.3.1 Rational choice

Assumptions of human behavior

Rational Choice Theory is an economic theory stating that people make persistent judicious and logical decisions. Rational choice makes several assumptions about decision-making processes. One very common assumption is that all human beings base their decisions on rational calculations of specific costs and benefits, which permits them to act rationally in making choices that are aimed at maximizing profits while reducing losses (Kleinschmidt *et al*., 2016). The theory emphasizes the benefits and costs of the rational agent's decision-making but ignores the social consequences of an individual activity that might have far-reaching impacts on future generations (Kleinschmidt *et al*., 2016). For example, land-users' decisions to maximize their benefits by clearing forests, converting wetlands into agricultural lands, or slash and burn may give better yields, but often at the expense of degrading the resource base upon which they depend. Another example is stream-bank cultivation, which has both immediate and long-term consequences, such as soil erosion, which in turn causes the siltation of water bodies: when chemicals such as fertilizers, pesticides and herbicides are used and later washed into bodies of water, the latter become polluted (Hancock, 2002). In broad terms, many of the assessments of economic alternatives by rational choice theory tend to be limited to financial considerations, although costs and benefits can be non-financial as well as financial (Kleinschmidt *et al*., 2016). This has been confirmed by a study of social farming by Leck *et al*. (2014), whose results varied for farmer's dependence on farming activities as a source of income, where 36% of studied farms in the UK depended mainly on income, 33% were partially reliant on income, and 31% were reported to not depend on income at all. The farms that do not depend on monetary benefits to at least some extent continue farming for various non-monetary benefits. Non-financial/monetary benefits and costs may include simply the provision of efficient services in their area, contributing to the viability of farms, creating employment, enhanced social inclusion and self-esteem, and improvements to the quality of life and the image of farming in the area (Garcia-Llorente *et al*., 2016). Also, non-financial benefits may come in the form of technology transfers, training, any form of contribution towards sustainable land-use practices, improved food security, lower food costs, increased productivity, increased market opportunities, sustainable production methods, protection of biodiversity and reduction of genetic erosion (Lau *et al*., 2011).

Confrontation of costs and benefits

The assumption that most individuals select the option that offers the highest rewards at the lowest costs and that the person has full and accurate information on which to base choices overlooks the role of society in remote and marginalized areas that are isolated and rarely receive information, as this assumes that all individuals have equal access to information. The rational agent is also expected to predict events and to calculate the potential costs and benefits to enable the best choice of actions to be made (Bandura, 2002). By so doing, rational choice theory places the emphasis on the determinants of individual choices and the financial attractiveness of their choices, which are often linked to preferences, capacities and the expected profits of different land-use practices (Kleinschmidt *et al*., 2016). However, predicting events may prove difficult, especially with ever-changing political, economic and environmental conditions. This in turn makes planning and deciding excruciatingly difficult and may explain why some individuals opt for short-term investment decisions rather than long-term ones.

The process of choosing alternatives

Rational choice theory also assumes that decision-makers have full knowledge of all relevant aspects for their decisions, a steady set of preferences for evaluating choice alternatives, and limitless calculating skills (Becker, 1993; Von Neumann and Morgenstern, 2007). Also, it is assumed that all economic actors have complete inventories of all possible alternatives of action (Simon, 1991). Such assumptions tend to exaggerate the knowledge, options and skills that rational agents are expected to have while ignoring the individual differences in capacities, as well as the contextual differences that favor specific options over others. Practically this would mean that all rational agents have to choose between several alternatives, ignoring situations where alternatives are limited or non-existent while assuming an infinite amount of time is available allowing everyone to scrutinize all the possible consequences, estimate personal probability and utility, multiply the probability by the utility, and sum the result of each consequence to obtain an alternative's subjectively expected utility (Gigerenzer and Selten, 2001). This overly stated assumption largely ignores differences in the cognitive capacity of individuals and the limited time and resources that most individuals have in the process of making their decisions. Apart from these limitations, other factors might interfere with the decision-making processes of individual farmers, such as context and the general scarcity of resources. Resource scarcity is often understood as the central economic problem that greatly influences individual decisions (Barnier, 1989). Choosing between alternatives involves the selection and realization of justone option and foregoing all the other options and the benefits that may be associated with them (Kleinschmidt et al., 2016), which in turn creates opportunity costs. Opportunity costs are derived fromforgone choices or sacrificed alternatives which at the time of deciding may be known to involve a risk with a probabilistic outcome and payoff probabilities (Kahneman and Tversky 1979, 1982), or uncertainty where the outcome is probabilistic and the decision-maker does not have complete information on payoff probabilities (Ellsberg 1961; Camerer and Weber 1992). In practice, decisions and computations are carried out for the future: as such, payoff probabilities cannot be determined with certainty, often giving rise to speculative results, as well as expected values or benefits (Hanson, 2003). In cases where the alternatives are clear in terms of their low level of benefit – for example, getting a bank loan at 6.5 percent interest and a profit margin of less than 2 percent – decisions to forgo the loan are more sensible, and the opportunity cost of foregoing this alternative is also low. However, the opportunity costs and risks of not having money for inputs may be higher, particularly for resource-poor households, and they may have devastating effects on household food security. Thisis particularly true when a limited resource used on one enterprise reduces the opportunity to use it on another (FAO, 2008).

Rational decision-making in times of crisis

The literature on decision-making in socio-ecological systems and agricultural systems generally shows a trend towards a change in behavior among farmers over time (Feola and Binder, 2010), who in times of crisis, because their conditions drastically change, have to adjust and adapt to the changes. For example, those experiencing adverse weather conditions (drier and short rainy seasons) are more

likely to change their behavior to adapt to and adopt the changes they experience (Monjane, 2018). Also, experience provides a learning opportunity and adaptation to changing conditions, where actors devise innovations and practices to manage risks. Under harsh climatic conditions, reliance on agriculture alone is not a wise decision (Frelat *et al*., 2016), therefore some farmers are more likely to make diversification decisions, particularly in relation to off-farm economic activities. This depends on their social situations, which differ significantly across settings (Haggblade *et al*., 2010), and the availability of products and/or labor markets within or beyond their localities. With limited options, especially during a crisis, it may be difficult to earn an income when people have no money (Dekker and Kinsey, 2011) or when markets and logistics crumble and banks stop issuing loans. In these circumstances, people may end up taking distress diversification decisions (Sheehan, 2011), such as disposing of some of their assets like livestock or abandoning their land completely because they cannot withstand repeated crop failures or livestock mortality due to unseasonal rains, droughts, floods, diseases or pest attacks. However, when market opportunities arise, perhaps in daily and cash crop markets, the likelihood of farmers deciding to switch to cash-crop production or mixed farming increases, particularly when the production is linked with credit and extension services, which can significantly raise the income revenues of rural households (Hounkonnou *et al*., 2012).

Criticisms of rational choice theory

Several scholars and scientists have criticized rational choice theory from several perspectives. The portrayal of actors by rational choice theory as inherently selfish and concerned only with their own best interests is refuted by others, who have observed that actors are not always selfish (Bruch and Feinberg, 2017), that preferences are not static features of individuals (Lindenberg and Frey, 1993), and that actors do not necessarily behave in purposive and optimal ways (Vaughan, 1998). Rational choice theory has also been criticized for its unrealistic and overly simplistic assumptions, especially about the ability of individuals to make choices and predictions using the available information (Gigerenzer, 2001). The argument is that people rarely have full or accurate information, as there never is adequate information for them to rely on, particularly on imminent events like climate change (rises in temperature, droughts, floods, veld fires, diseases and pests), price fluctuations, changes in policy frameworks, etc. (Kleinschmidt *et al*., 2016). For this reason, people are bound to decide using the little information they may have at their disposal. Also, decision-making, as envisioned by rational choice, makes overwhelming demands on the individual's capacity to process information (Bruch and Feinberg, 2017), as decision-makers are said to have limited time to learn about alternative choices (Payne *et al*., 1976).

The literature on agricultural systems shows that the majority of rural farmers hardly have any information available and are inadequately served by research and extension services due to certain generic agricultural challenges (Mmbengwa *et al*., 2009). Moreover, efforts by farmers to obtain information themselves might be costly and take too much time, quite apart from the time needed to process it. This lack of information makes it difficult for some people to behave rationally. Loomes and Sugden (1982) argue that in reality many people behave differently: for example, when farmers have limited options and struggle to cope with the risks and uncertainties (first as a pervasive feature of farming, and second as presented by crises), they tend to behave in ways that allow them to survive, which often is more powerful than reasoned logic based on optimization. Also, maximizing profits is not the only motivation that keeps farmers alive: some farmers have very strong values and beliefs in living in and keeping the family property, so they will not abandon the land, while others simply enjoy farming not necessarily for profits but for their sustenance. As such these personal goals and ambitions often outweigh rational economic decision-making (Bruni and Uelmen, 2006) and may be driven by a host of factors, such as social structure and context-specific environmental features. Often farmers' decisions that seem illogical and irrational to non-farmers make perfect sense to those who are making the decision: for example, from a financial perspective it may be more attractive to grow cash crops like tobacco, cut down trees for the treatment of golden leaf, or even clear land for agricultural purposes without necessarily selling stocked timber, rather than sustainably managing the forests (Pearce, 2001). Critics also argue that the ability of a so-called rational individual is limited to

conducting analyses and thinking through competing alternatives, particularly for rural farmers, who have to deal with risks and challenges on an everyday basis (FAO, 2017). Others argue that decision-makers have limited time to learn about different choice alternatives (Bruch and Feinberg, 2017), as they also suffer from limited working memory, as well as a limited ability to make calculations (Payne *et al*., 1993). As a result, individuals tend to use heuristics, habits or forms of social imitation to keep the demand to process information regarding their choice within the bounds of their limited cognitive capacity as problem-solving methods in difficult situations (Gigerenzer, 2001).

2.3.2 Behavioral economics

Like the rational choice view of behavior, which assumes that *homo economicus* is descriptively and normatively adequate, behavioral economics treats *homo economicus* in accordance with normative guidelines (Kahneman, 2003; Thaler, 2016a) and as a benchmark for measuring observable human behavior (Webb and Lazzaro, 2019). *Homo economicus* is a term used to portray humans as agents that are consistently rational and self-interested in optimizing their benefits. Rationality, on the other hand, is defined by Simon (1982) as a style of behavior that is appropriate to achieving the set goal(s) under certain conditions and constraints, hence can better be explained as subjective or bounded rationality. Behavioral economists place the individual and human behavior at the center of their analyses. It assumes that the behavior attributed to *homo economicus* by rational choice is not adequate to describe human behavior (Mullainathan and Thaler, 2000). The reasons put forward for this are that rationality is limited when individuals make decisions, regardless of how intelligent they may be, and that there are inevitable constraints that interact with their decision-making processes. These constraints include the cognitive limitations of the mind to evaluate and process whatever information available to them. In terms of information, only limited and often unreliable information is available for possible alternatives and consequences, and last but not least, there is a limited amount of time in which to make decisions (Payne *et al*., 1993). This means that even individuals who intend to make rational choices are also bound in some way, which often results in them making sacrifices instead of maximizing choices, particularly in complex situations (Simon, 2001). Also, the existence of limited and unreliable information means that decision-makers are only able to apply rational decisions to a few choices based on their cognitive and computational capacity. These limitations play a role in decision-making, particularly among rural farmers, most of whom are inadequately served by research and extension services (Asiedu-Darko, 2013), as well as being less educated, thereby compromising their cognitive capacities to make decisions (Sproten *et al*., 2010). Conversely, in crises farmers may require prompt decisions, such as how to put food on their table or how to raise the income to pay for inputs and other household requirements. Hence, Herbert Simon, Tversky and Kahneman, Lola Lopes and others provided new foundations to explain human behavior using bounded rationality. In the following section, we take a close look at the concept of bounded rationality.

In analyzing rural socio-ecological systems that comprise a configuration of actors to explain social changes in the lives of farmers, it is important to look at the rational decisions of the individuals that make up the whole, and not only in isolation. For example, how should one explain the common decision-making strategy among rural actors that consists in imitating the behavior of others (Gigerenzer, 2001), also known as social learning (van Bommel *et al*., 2009), especially in cases where the optimization strategy is unknown. In the same way, many factors influence decision-making, for example, the roles of culture (Palis *et al*., 2006), social norms (Heong *et al*., 2002), the social context (Nkamleu and Adesina, 2000), imitations of peers (Schmit and Rounsevell, 2005), attitudes and perceptions (Zubair and Garforth, 2006), and other eventualities that might influence farmers in an action context (Waichmann *et al*., 2007), including the lack of adequate information or support. Drafor (2016) found that small farmers relied greatly on other farmers, whom they ranked as their most important and least expensive source for the acquisition of relevant information, entailing imitating what others have done successfully.

2.3.3 Bounded rationality

The use of heuristics in decision-making processes

Bounded rationality refers to the idea that rationality is limited when individuals make decisions. Daniel Kahneman and Amos Tversky provided a map of bounded rationality in which they explored the psychology of intuitive beliefs and choices and the systematic biases that separate the beliefs that people have and the choices they may make from the optimal beliefs and choices assumed in rational-agent theory (Kahneman, 2003). The concept of 'bounded rationality' was first pioneered by Herbert A. Simon (1955), who proposed that decision-making must be viewed as involving a bounded rationale, for which he offered a model of sacrificing as an alternative to utility maximization. Several other researchers have explored the heuristics that people use in decision-making and the biases to which they are prone in various tasks involving judgement under uncertainty (Kahneman *et al*., 1982; Tversky and Kahneman, 1974). Unlike rational choice theory, which assumes that *homo economicus* distinguished by a steady set of preferences, behavioral economics considers individual behavior to be determined by rules, heuristics, desires, moods, emotions and many other things (Bodenhausen, 1993). Kahneman and Tversky maintain that people cannot carry out the tasks of correctly making numerical predictions and calculating probabilities in their efforts to cope with the complexities of their everyday tasks, so they use heuristics, such as intuitive judgment, educated guesses, common sense, learning and discovery or trial and error, which are fast and reliable. However, while in certain cases these heuristics are useful, at other times people make serious and systematic errors or biases (Kleinschmidt et al., 2016), for example, when they choose to overexploit the available resources and thus trigger competition and conflict over scarce resources, with impacts on chronic poverty in the future (FAO, 2017; Sunderlin *et al.*, 2005).

The role of memory and emotions in decision-making

Memory and emotions play a key role in decision-making, particularly when that involves taking risks that may result in major losses such as reduced crop yields due to drought and pests, loss of livestock due to diseases, and loss of income due to price fluctuations and/or stiff competition. Kahneman and Tversky (1979) further show that, above and beyond rational considerations, people often have a tendency to refer to associated memory and emotions, which can be grouped into four distinct forms of behavior, such as preferring certainty, avoiding loss, submitting values to individual assessment and disregarding minor probabilities. This is particularly true when decisions are intuitively made using a set of reference points and when the outcomes of economic decisions above certain reference points are regarded as gains, anything below being losses (Kahneman *et al*., 1991). Similarly, people have also the tendency to compare changes rather than compute exact values: for example, changes in commodity price change might negatively influence a switch to alternative production systems without fully processing the alternative and its consequences. Another important insight here relates specifically to the personal experiences and opinions of others in evaluating costs and benefits and the level of trust accorded to peers in comparison with the use of scientific information, which might be available but is not necessarily easily understood. Such reliance on local-level information has maintained indigenous knowledge systems in most rural indigenous communities, despite their not being properly documented. Other researchers explain how social structures influence decision-making processes, concluding that individual actions are bounded and determined by social contexts (Kleinschmidt *et al*., 2016; Bruch, 2017). For example, in rural settings, where traditional leadership has an overall say on how resources are accessed, used and managed, individuals' actions tend to be guided along with these social structures.

The role of anxiety and uncertainty in decision-making

Bounded rationality theory also exemplifies the failure of people to make rational decisions due to anxiety and uncertainty. This is supported by the economist Richard Thaler's idea of mental accounting, which states that people behave irrationally by placing greater value on some options thanothers, even when the benefits are the same. For example, some prefer cash-crop intensification, whileothers may opt for dairy production: both provide reasonable incomes, even though one is seasonal, while the other one could provide a continuous income as long as dairy cattle can produce. However,

the uncertainty caused by changing weather patterns, which significantly reduce agricultural productivity and pastures, may force others to decide on diversification or distress-coping decisions. Here decision-makers may also opt for ways of not optimizing benefits, but may be willing to choose a more acceptable option rather than an optimal one (Samson, 2014). Behavioral economics also sets out to analyze decisions taken under conditions of fundamental uncertainty and where the risk remains unknown (Lawso, 1985). This is in line with the focus in this study on analyzing farmers' decisions in a context of risk in relation to the environmental, economic and political crises that have created uncertainties. Under conditions of uncertainty, farmers tend to weigh the potential losses more than the gains, an explanation in line with Prospect Theory (Kahneman & Tversky, 1979). Although Prospect Theory maintains the concepts of utility maximization, it ranks losses twice as highas gains (Kahneman & Tversky, 1979), which would lead poor farmers to choose short-term risk- avoidance options which may be fast and effortless.

Use of incomplete information in decision-making

Another important insight of the theory of bounded rationality is that decisions tend to be made with reasonable amounts of calculation but incomplete information (Bruch and Feinberg, 2017). This means that comparatively good decisions can be made without necessarily scrutinizing all the available alternatives, as it is almost impossible to analyze different alternatives rigorously, especially in situations of crisis. In a prolonged research program, Tversky and Kahneman verified the predictions of perfect rationality theories by showing several ways in which individuals systematically deviate from what would be expected by maximization theories. However, individuals' preferences may be affected when irrelevant features override chosen options or outcomes as a result of inaccurate information (Tversky and Kahneman, 1981). Tversky and Kahneman also investigated decision-making under conditions of risk. To this end, they show that decision-makers take into consideration the probable gains and losses and do not focus only on positions of wealth; by so doing, they differ from Bernoulli's model, which suggests that the initial state of wealth affects choice (Kahneman and Tversky, 2013). This is particularly true, as the majority of rural farmers are anyway poor. As such they do not possess the wealth or agricultural assets that could be used as the basis of their choices.

Maximizers vs satisfiers

Similarly, Simon (1957) identified two cognitive styles, maximizers and satisfiers, the latter being those who simply try to find a solution that is 'good enough' for their situation. This is not necessarily the best solution: for example, deciding on reducing costly inputs and concentrating scarce resources on the most suitable land to satisfy household consumption. This might not be the best alternative if the household is not able to generate incomes through agricultural activities, but it will certainly be good enough when household food security is guaranteed. Another typical example is when households decide to overexploit the natural resources around them for their survival: this is not the best option, as it perpetuates environmental degradation, creating a vicious cycle trapping poor households in poverty. Here, emotions may take center stage, as they tend to influence decision-making processes, which often occur in the face of uncertainty without calculating the cost of benefits or the harm of one's choices. Satisfying is also used in consensus-building, especially when groups of people look for a solution everyone can agree on, for example, the establishment of farmers' organizations, groups, associations and cooperatives for irrigation projects or member-based savings and lending groups. Despite recognition of it as an inferior decision-making strategy, satisfying is ecologically rational, in particular regarding environmental decisions, as they can sometimes outperform alternative decision strategies (Gigerenzer *et al*., 1996). For example, in difficult situations, farmers may decide to reduce the size of land they place under cultivation, or they may significantly decrease herd size in drier pasture conditions. This study draws on rational choice theory, particularly the philosophy of the axiom of choice (Friedman and Hechter, 1988), but complements it with behavioral economics. The study uses the following three essences of decision-making: the decision's goals, the set of choices, and the set of selection criteria or strategies. For this reason, Kahneman (2003, winner of a Nobel prize, proposed in his speech to explore the systematic biases that separate peoples' beliefs and choices from the optimum beliefs and choices presumed in rational agent models. Angner (2014) argues that,

through Kahneman's systematic examination, researchers will be able to determine whether a person behaves according to the assumptions of *homo economicus* and also show levels of behavior that deviate from the concept. Others, however, uphold the neoclassical benchmark as a normative model, as when Richard Thaler (2016) argues that 'expected utility theory remains the gold standard for how decisions should be made in the face of risks.' Yet others reject entirely the *homo economicus* concept, particularly researchers on social norms, who consider how other peoples' expectations directly influence one's own behavior (Kersting and Obst, 2016), for example, the role of government in deciding land-use practices through extension services.

However, environmental conservationists tend to illuminate only the benefits of sustainable land-use practices without highlighting the economic, social and environmental consequences. Usually the benefit flagship fails to entice people into adopting new technologies, as people require high payments to change their behavior (Kleinschmidt *et al*., 2016) and are mostly concerned about satisfying their immediate needs, like food. The available literature on financial attractiveness shows that losses are weighted twice as influential as gains (Kersting and Obst, 2016) and that people try to avoid actions with small probabilities to avoid losses rather than acquiring gains (Kleinschmidt *et al*., 2016). Similarly, people may find it difficult to measure and evaluate precisely factors among the choice criteria when making decisions, particularly in crises. For this reason, other researchers have proposed some alternative theory, such as Amos Tversky's and Daniel Kahneman's Prospect Theory. The empirical findings of Prospect Theory show that people fear losses more than they value gains, resulting in them considering the probabilities of negative outcomes more seriously than their actual possible costs. In the same reasoning, bounded rational theory suggests that people would rather accept a deal that provides a certain probability of gain than losses. This behavior resonates with some farmers' decisions to diversify crop production in order to increase the food available at the household level and to store it as a buffer against shocks like price hikes for basic foodstuffs and unpredictable weather patterns, which may result in some failed crop yields.

2.4 Factors that influence farmers' decisions

There is much empirical evidence of the wide range of factors that help shape farmers' decisions and choices (Meijer et al., 2014). In general, the majority of statements document the most important factors, such as age, education, gender, family size, financial situation, farm experience, agricultural assets, lack of support, remoteness, lack of access to market, social organization and climatic conditions (Tamane and Megento, 2017; Frelat *et al*., 2016; Ngwira *et al*., 2014; Meijer *et al*., 2014; Pokorny, 2013; Greiner and Gregg, 2011; Hassan and Nhemachena, 2008; Aramyan et al., 2007; Dolisca *et al*., 2006). These factors were put into four specific categories, namely nature (climatic conditions), institutions (social organization and support, both technical and financial), internal or household features (age, family size, gender, education, farm experience and financial situation), and farm-level features (land ownership, farm size, farm assets and distance to markets (Table 3). For farmers operating in times of crisis, issues to do with risks, uncertainty, scarcity of resources and other contextual factors play a central role in influencing their decisions. The here listed features helped in finding, evaluating and synthesizing the factors that influence farm decisions. Using this list, the study has been able to identify existing literature about each of the factors listed, as well as identify the gaps it seeks to cover.

2.4.1 Farm features

Several features distinguish one farm from another, but the most common are land ownership, farm size and farm assets. Some studies have shown how these factors influence, for example, investment decisions, the level of productivity a household is capable of and the options available, particularly agricultural activities (Mwase *et al*., 2015; Rights and Resource Initiative, 2015). In the following sections, a detailed description of the three most important farm features is given.

2.4.1.1 Farm assets

Farm assets come in a variety of forms, but the key assets are land, water and livestock. Empirical evidence shows that the majority of farming households in developing countries suffer from a lack of assets (Asfaw et al., 2019; Monjane, 2018, Ngwira et al., 2017; Frelat et al., 2016; Murendo et al., 2016; Harvey et al., 2013, World Bank, 2008). Farm assets have been identified by many authors as having significant influences on the economic choices of rural households (Murendo et al., 2016; Ngwira et al., 2014; Hassan and Nhemachena, 2008). Having sufficient land to cultivate crops and keep livestock may influence crop-livestock integration on a larger scale. However, due to limited grazing land, many rural farmers have to restrict the number of livestock they can keep within the household or switch to small livestock production, which can easily be managed on their available farming land.

Table 3. List of decision-influencing factors and authors

Factors	Authors
Farm Level Features	
Farm assets	Asfaw et al., 2019; Monjane, 2018; Frelat et al., 2016; Harvey et al., 2013; Murendo et al., 2016; Lioson, 2015; Ngwira et al., 2014; Greiner and Gregg, 2011; Winters et al., 2009; World Bank, 2008; World Bank, 2007; Nhemachena and Hassan, 2007; Moll et al., 2004; ODI, 1999
Farm size	Mwase et al., 2015; Gollin, 2019; Deininger and Castagnini 2006; Hassan and Nhemachena, 2008; Williams, 2007; Adesina and Djato, 1996; Anim, 2008; Anley *et al*., 2006; Okoye, 1998; Nyangena, 2007; Barrett *et al*., 2009; Foster and Rosenzweig, 2010; Otsuka e al., 2013; Pittelkow *et al*., 2015; Dekker and Kinsey, 2011; Monjane, 2018
Land tenure	Whitehead and Tsikata, 2003; Matondi and Dekker, 2011; Ubink and Amanor, 2008; Colchester et al., 2001; Dolisca et al., 2006; Lawry et al., 2017; FAO, 2017
Remoteness	Winter et al., 2009; Asfaw et al., 2019; Tamene and Megento, 2017; Lioson, 2015; Meijer et al., 2014; Harvey et al., 2013; Kassie et al., 2017; ODI, 1999; FAO, 2015; Stifel *et al*., 2003; Hine and Ellis, 2001; Ashagidigbi *et al*., 2011; Diao *et al*., 2010; Chimitz and Gray, 2013; Ziervogel *et al*., 2006; Barret, 2008; Sisay, 2017
Personal Features	
Age	Asfaw *et al.,* 2019; Murendo *et al*., 2016; Meijer *et al*., 2014; Zhou *et al.,* 2008; Hassan and Nhemachena, 2007; Greiner and Gregg, 2006; Kassie *et al*., 2018; Kamu *et al*., 2014; Burton, 2014; Zhang and Flick, 2001; Sun *et al*., 2018; Dolisca *et al*., 2005; Anley *et al*., 2007; Bayard *et al*., 2007; Lio *et al.,* 2019
Gender	Moll *et al*., 2004; Zhou *et al*., 2018; Agarwal, 2018; Lioson, 2015; Meijer *et al*., 2014; World Bank, 2014; FAO, 2011; World Bank, 1994; Asfaw *et al*., 2019; Enete and Amusa, 2010; Nilakashi, 2019; Mahmuda and Yoshihito, 2008; Mulugeta and Amusala, 2014; Kura and Yero, 2013
Level of education of household head	Asfaw *et al*., 2019; Murendo *et al*., 2016; Frelat *et al.,* 2016; Meijer *et al*., 2014; Pokorny, 2013; Aramyan *et al*., 2007; Dolisca *et al*., 2006; Hggblade *et al*., 2005; Lioson, 2015; Enete and Amus, 2010; Britt and Shrestha, 1998
Family size	Asfaw *et al*., 2019; Nhemachena and Hassan, 2007; Ngwira *et al*., 2014; Dekker and Kinsey, 2011
Household financial situation	Asfaw et al., 2019; FAO, 2018; Haggblade *et al*., 2010; Barret et al., 2001; Losch et al., 2013; World Bank, 2008
Farm experience	Jack *et al*., 2007; Murendo *et al*., 2016; Moyo *et al.,* 2012
Institutions	
Financial support	Haggblade *et al*., 2010; World Bank, 2008; Moll *et al*., 2004; Dzvimbo *et al*., 2017; Campbell *et al*., 2001; Harvey *et al*., 2014; Lioson, 2015; Pokorny, 2013; Wolfenson, 2013; Haile, 2005; FAO, 2010; Greiner and Gregg, 2011; Rose *et al*., 2016; Vrain and Lovett, 2016; Batje, 2012; Asfaw *et al*., 2019; Ekwene and Edem, 2014; Olagunju and Adeyemo, 2008; FAO, 2000; 2010; 2012; Lioson, 2015; Dekker and Kinsey, 2011; Trzeciak-Duval, 2003; Lane *et al*., 2018; Godfary *et al*., 2010
Extension services	Murendo *et al*., 2016; Meijer *et al*., 2014; Haggblade and Hazell, 2010; Moyo and Besade, 2008; Braizer, 2017; Ruben *et al*., 2006; FAO, 2008; 2013
Collective Action	
Social organization	Efendiev and Sorokin, 2013; Pokorny, 2013; Xu et al., 2013; Zelner et al., 2012; Putnm, 1995; Granovette, 2005; Lanjouw and Lanjouw, 2001; Farh et al., 1997; Cloupkov et al., 2003; Barret et al., 2001; Lovenda et al.,2004; Anderson, 2007

In difficult situations, it is problematic for farmers lacking assets to switch between assets and activities when they only have a few of the former (ODI, 1999). For most poor rural farmers, it is difficult to adapt to unforeseen trends and hazards due to the lack of assets to fall back on, which limit their ability

to recover from multiple stressors (Monjane, 2018). The ability of poor farmers to adopt sustainable land-use practices in the face of adverse weather events has been documented by many researchers, who show that farm assets significantly affect adoption decisions (Asfaw *et al*., 2019; Monjane, 2018; Frelat *et al*., 2016; Lioson, 2015; FAO, 2015; Harvey *et al*., 2013; Hassan and Nhemachena, 2008). This study expects that ownership of key farm assets improves farmers' ability to adapt and cope with crises, particularly adverse weather events, as they can substitute available assets and activities. For example, the availability of water and land influences farmers' decisions to establish irrigation schemes, which in turn helps them produce all year round, increasing productivity and food security for their households. The literature on measuring rural wealth uses land, particularly farm size, household incomes and cattle ownership (Murendo *et al*., 2016). This study expects wealth and livestock ownership, not only of cattle but also of smaller species, to have positive effects on farmer's investment capacity and subsequent ability to cope effectively with crises. Historically, the limited assets of most rural households are often depleted by adverse shocks, thereby increasing rural farmers' inability to cope effectively with crises and forcing them to engage in low-risk and low-return activities (World Bank, 2007). Important to note also is the impact of income from remittances, which often is used to increase and/or improve land, livestock and the human capital base of those rural household members who have remained behind. Such remittances can also help remaining household members offset income shocks while at the same time helping them to protect the household's productive asset base (World Bank, 2008). FAO (2013) provides empirical evidence from the *Oportunidades* program in Mexico showing that public transfers can likewise lead to investments in productive activities and risk coping.

The factors described above are by no means exhaustive, but are rather key factors that other researchers have identified as influencing the decisions and choices farmers make. Such factors apply to all rural farmers in general, but more specifically to farmers in developing countries in Africa, Asia and Latin America. Many studies focus on analyzing the factors that influence farmers' decisions in general conditions: very few studies have devoted themselves to analyzing farmers' situations in crises (Dekker and Kinsey, 2011; Besada and Moyo, 2008). As such, this study aims at contributing to the debate on which factors influence which decisions and choices of farmers in times of crisis. A conceptual framework (Figure 1) at the end of this chapter gives a summary of the vulnerable situations in which farmers have to make informed decisions on what to grow, when to grow, and how much to grow.

2.4.1.2 Farm size

Several studies have looked at the relationship between farm size and decision-making (Mwase *et al*., 2015) and at productivity (Gollin, 2019). In practice, the size of the farm and the number of commodities it grows are often used to measure the size or scale of the farm enterprise that individual households undertake (Lewis, 1997). Empirical results are mixed, particularly on the relationship between farm size and decision-making processes for poor rural farmers (Mwase *et al*., 2015; Hassan and Nhemachena, 2008). The relationship between farm size and productivity has led many to the conclusion that the redistribution of land is of paramount importance for purposes of efficiency (Williams, 2007). For example, a study in Côte d'Ivoire revealed evidence of the allocative inefficiency of large rice farms (Adesina and Djato, 1996), while Deininger and Castagnini (2006) found an inverse relationship between farm size and productivity in Uganda. Conversely, a study in South Africa showed no significant relationship between farm size and the adoption of, for example, conservation practices (Anim, 2008). Others, however, found that farmers with large farms had enough land to allocate, for example, soil bunds and improved cut-off drains in Haiti (Anley *et al*., 2006) and Nigeria (Okoye, 1998). Similarly, Nyangena (2007) found that farmers with only a small area of land were more likely to invest in soil conservation than farmers with a large area. Some other studies observed an inverse farm size–productivity relationship in developing countries in Asia (Lipton 2009), and similar results have been found in sub-Saharan Africa (Barrett *et al*., 2009). However, other studies show that in some developing countries, large farms' decision-making procedures and productivity relationships are significantly greater than in the case of their small-farm counterparts (Foster and Rosenzweig, 2010;

Otsuka e al., 2013). The available literature on the relationship between farm size and productivity is far from being conclusive, as most of it is based on data from very small areas with limited variation in agricultural production systems (Pittelkow *et al*., 2015). While these studies have therefore revealed mixed results between countries, few studies have set out to assess farmer's behavior in times of crisis, regardless of land size, particularly the decision to reduce the area of cultivated land (Dekker and Kinsey, 2011) in response to, for example, unaffordable input costs. It is expected that farmers with large farms are more likely to adopt diversification strategies for economic gain, while small-sized farms may diversify as an effort to broaden the variety of food available for consumption by their households. Evidence from the literature on crop diversification by poor households with smaller areas of land revealed three benefits in terms of spreading risk, health and household food security respectively (Monjane, 2018).

2.4.1.3 Land tenure

Land tenure is typically a matter of tenure rights to land, whether formally individualized or informal and collective in a group or community. Land ownership has largely been used to describe the relationship to land, whether defined legally or customarily, and whether on an individual or group basis (Whitehead and Tsikata, 2003). Throughout history, many different forms of land ownership have been established (Matondi and Dekker, 2011; Ubink and Amanor, 2008), property rights that can be categorized as private or formal, communal or informal, and open access or state-owned. 'Land tenure' is commonly used to describe the different forms of landownership and has been defined as an institution that comprises rules created by societies to regulate how property rights to land are to be allocated within societies (Colchester *et al*., 2001). Such rules spell out who can use what resources for how long and under what conditions. Numerous researchers have claimed that well-adapted rules of land tenure can promote sustainable land use and that insecure land tenure may be linked to poor land use that often leads to environmental degradation (Colchester *et al*., 2001). The available literature on landownership argues that the latter can promote land-use practices that can either enhance or harm the environment (Dolisca *et al*., 2006) and that inappropriate rules (formal or informal) for gaining access to land can also lead to environmental degradation (Colchester *et al,* 2001). However, several pieces of literature on land tenure show that the majority of poor farmers suffer from insecure land tenure, as most governments fail to recognize and protect informal tenure rights (Colchester *et al*., 2001), despite some efforts to regularize customary tenure rights by some governments (Lawry *et al*., 2017). Landownership is expected to influence farmers' decisions over whether to produce for profit, make improvements to the land or increase the productivity of both crops and livestock. It is also expected that those without access or with limited access to land will in turn focus on other economic activities, particularly off-farm, agricultural wage and non-agricultural income-generating activities. While landlessness may have other reasons than insecure tenure, such as distress sales, where some individual households are forced to sell their land to survive in times of crisis, such as famine, sickness and other calamities (Colchester *et al*., 2001), others may be forced to abandon their land completely, particularly in war situations (FAO, 2017). In a study by Colchester et al. (2001), the authors concluded that, 'without the security of tenure, households are significantly impaired in their ability to secure sufficient food and to enjoy sustainable rural livelihoods'.

Empirical evidence for the influence of land tenure

There is evidence from numerous studies across the globe generally supporting the conclusion that land is negatively associated with non-agricultural activities (Deininger *et al*., 2014). In Nicaragua, for example, Corral and Reardon (2001) found a positive but rather diminishing effect of land on total farm incomes and a negative link with non-agricultural wage employment, as well as farm wage income. Such negative relationships between land ownership and participation in non-farm employment and income generation has been shown in several studies on a range of countries, including China (de Janvry *et al*., 2005; Zhu and Luo, 2005), Ecuador (Elibers and Lanjouw, 2001), India (Lanjouw and Murgai, 2009) and Chile (Berdegue *et al*., 2001). Landownership, of course, seems to influence what farmers do on the farm or whether households shift to non-farm activities for their survival. Such a relationship is particularly strong in countries where land scarcity is a major problem, as in Asia and

some countries in Africa, where limited land ownership suggests limited options (Lanjouw and Lanjouw, 2005).

Land tenure as a major source of conflict

Land tenure has been identified by many authors as the major source of conflict across the globe, threatening environmental conservation and efforts to combat climate change (Clover and Eriksen, 2009). Given the increase in population growth and decline in the area of arable land, competition over land ownership, for example in sub-Saharan Africa, can be found in almost every country where power, wealth and survival are measured by the ownership and control of land as a vital resource needed for sustenance (Haggblade *et al*., 2010). Given that about 70% of rural populations depend on land for their livelihoods, the struggle to control land often results in conflict (Havnevik, 2007). Some conflicts over land ownership have arisen between farmers and cattle-herders, becoming an unending problem in some countries, which makes legal protection against conflict over land ownership imperative (Fisiy, 1992). Similarly, the inequitable control of land by the powerful accumulating large tracts of land also causes conflicts over land ownership (Moyo 2008). In some countries, land conflicts have arisen from unclear boundary demarcation or the double allocation of some plots by the state and disputes over the use of common natural resources (Moyo, 2011). In practice, land conflicts often have widespread negative consequences on economic, social and ecological development for individuals, groups or nations (Wehrmann, 2008), particularly in countries where land market institutions are weak, land acquisition through corruption is widespread, and access to land by the poor is limited. Examples of land conflicts around the world include Guatemala, the recurring violent conflicts over land described by Unruh (2003), the Darfur land conflict fueled by environmental degradation (D+C 9/2007), Cambodia, where Cooper (2005) reports an estimated 850,000 people affected by land conflicts, and Ghana, where the courts had to deal with 60,000 land-related cases in 2001 (Wehrmann, 2008).

In Sub-Saharan Africa, in practice a large share of the national land area is held under customary or traditional forms of land ownership: the problem lies with national governments, which do not formally recognize communities' rights to land (RRI, 2015). This is further compounded by the many disputes between neighbors and conflicts over inheritance, many of which are often about land (Wehrmann, 2008). Additional conflicts emanate from the engendered land redistribution through patriarchal lineage which greatly disadvantage women farmers. Such conflicts create insecurity, and although some countries are in the process of recognizing communities' rights, the data on such countries show significant gaps in recognition (RRI, 2015). Insecure ownership is thus a common characteristic of many developing countries where customary land ownership is practiced (Feder and Onchan, 1987). It is to be expected that security of ownership affects both investment incentives and the availability of resources with which to finance investment. Therefore, households with a land title are better able to access credit facilities than those without. The literature on land ownership confirms that land ownership is often used as collateral to access credit, making it a binding constraint on access to credit and meaning that security of security will likely lead to greater investment. Hence, ownership security improves both the incentive to invest and the ability to do so. There is empirical evidence showing that security of ownership promotes greater levels of farm investment and improvements to land (Sossou and Mbaye, 2019; FAO, 2013). A study by Place and Migot-Adholla (1998), however, found mixed results for Wassa district in Ghana, where there was no significant relationship, whereas in Angola there was a significant correlation between the percentages of complete land ownership and total credit use. Similarly, data on land improvements were mixed where, as in some areas, land ownership was not significantly linked to such improvements, whereas in other cases there was a link (Place and Hazell, 1998). The authors also uncovered interesting insights on investments and yields, especially where continuous investment in manuring and mulching in Rwanda and liming in Kianjogu in Kenya's central province was significantly related to landownership, which resulted in significant positive yield effects. Therefore, understanding the role played by security of ownership, particularly as it relates to access to credit as one of the major constraints most rural farmers face, becomes imperative.

2.4.1.4 Remoteness

Distances to and from markets may influence the type of on-farm and non-farm activities in which rural households partake. It is expected that proximity to markets provides opportunities to sell farm produce, purchase inputs and also engage in self-employment activities, including non-farm wage employment. Access to infrastructure and urban centers is expected to provide higher returns for certain agricultural activities through better access to inputs and greater opportunities to sell high-value crops like cash crops. While findings on the importance of infrastructure and distance to markets vary across different studies, such differences can probably be attributed to the different definitions researchers give to infrastructure and market access (Winters *et al*., 2009). For example, infrastructure could refer to storage, electricity, etc., but, for the purposes of this study, it refers to road networks that either promote or hinder access to markets. Poor road infrastructure in most rural areas makes transportation costs a disincentive for poor rural farmers to produce for profit (Tamene and Megento, 2017). The situation is even more difficult for farmers located in remote areas, as this is often associated with greater poverty and fewer livelihood options (Asfaw *et al*., 2019; Tamene, 2017; Lioson, 2015; Meijer *et al*., 2014; Harvey *et al*., 2013; ODI, 1999). Infrastructure in terms of road networks plays a key role in determining transport costs, especially for farms located far from markets. Much empirical evidence on rural infrastructure shows that most remote rural areas are inaccessible due to poor road networks, which makes transporting agricultural produce extremely expensive (Tamene and Megento, 2017). Besides the high transport costs, farmers situated in remote areas have difficulties in accessing public services like extension services, banks and agricultural inputs (FAO, 2015; Tamene and Megento, 2017). This in turn increases their vulnerability to shocks and restricts the economic opportunities that can be realized through trading (FAO, 2015).

Findings on the relationship between distance to the nearest markets and farmers' productivity and output are mixed. For example, Stifel *et al*. (2003) found a significant and negative correlation between distance to a market center and productivity. Similarly, Hine and Ellis (2001) found a decrease in the intensity of food production against an increase in the distance to markets. Such findings are in agreement with those of Ashagidigbi *et al*. (2011), who found a significant positive relationship between farmers' economic and agricultural output and the level of road access. Such findings seem to be consistent with other studies conducted in Asia and Africa (Kassie *et al*., 2017; Diao *et al*., 2010) showing how food prices are much more expensive in remote areas (Stifel *et al*., 2003). Similarly, the FAO (2015) found out that in Nepal the market price for rice in remote regions like the Terai, a region on the border with India, tripled in price compared to less remote areas. In a similar study in Ethiopia, it was found that distance from markets compelled small farmers to be subsistence farmers producing sufficient food for their own consumption (Kassie *et al*., 2017). Conversely, Chomitz and Gray (2013) found no statistical relevance between distance to markets and farmer's productivity. One possibility is that distance to markets influences farmers' decisions to engage actively either with the market by producing for profit or in non-farm activities to ensure survival (Ziervogel *et al*., 2006). This hinders farmers in taking economic opportunities from trading (Barret, 2008) while at the same time increasing their vulnerability to crises. I suggest that farmers located nearer to markets are more likely to have a link to markets to maximize profits. It is also expected that farmers located further from markets are more likely to engage in fewer low-return activities. Farmers also consider the distance to the nearest markets and costs. Despite this limitation in market participation, during crises farmers also consider diversification, not for profit but for their own survival (Sisay, 2017).

2.4.2 Personal Features

Household features refer to specific household characteristics like age, gender, education, experience of the household head, family size and financial situation. Several authors have identified these household factors as having a bearing on what farmers do (Asfaw *et al*., 2019; Murendo *et al*., 2016; Meijer *et al*., 2014; Zhou *et al*., 2008; Hassan and Nhemachena, 2008; Dolisca *et al*., 2006). The decision-making process for rural households that are struggling to cope with a crisis are complex and could be affected by a wide range of factors. The list given here is not exhaustive but highlights the most critical such features affecting farmers across the globe. It is acknowledged, however, that the

key factors affecting farmers in their efforts to cope effectively with crises lie in their ability to endogenously transform their situations willingly. This willingness to change is mainly linked to the so-called 'bounded rationality selection mechanism', particularly when certain internal and external constraints exist, such as the lack of credit and extension services, possession of few assets, limited or absence of support, distances to markets (mostly characterized by poor infrastructure and costly transportation), and harsh climatic conditions (Njenga and Davis, 2010). In these situations, farmers may have to compare alternative options and seek a more satisfactory solution to help them improve household food security and incomes. Below, I present a description of the household factors that influence their decision-making processes and use empirical evidence from different countries to illustrate the influence of these factors on decision-making.

2.4.2.1 Age

In the context of farms, age is evaluated with particular reference to the household head, whether young or old. The available literature on age shows mixed results regarding its influence on decision-making (Asfaw *et al*., 2019; Murendo *et al*., 2016; Meijer *et al*., 2014; Zhou *et al*., 2008; Greiner and Gregg, 2006). This study expects older household heads to be better able to deal with crises than young householders. The latter are more likely to migrate to urban centers or abroad in search of remunerative employment as one way of diversifying sources of income. It is also expected that the older the householder the more attached they are to their land and the more farm experience they have acquired over the years, which can be used as points of reference that may influence their behavior. Similarly, Hassan and Nhemachena (2008) also agree with this reasoning that older farmers are more likely to adapt to harsh climatic conditions due to their age and exposure over the years. While the assumption that older households have more experience is widely shared, however, some critics associated older household heads with a loss of energy, a tendency to short-term planning and more risk-averse attitudes compared to young farmers (Kassie *et al*., 2018; Kamau *et al.,* 2014).

The literature on age also extends to other authors who have found no influence of the age on farmers' choices at all (Burton, 2014; Zhang and Flick, 2001). Similarly, in a study in China, Sun *et al*. (2018) found age to have no significant influence on farmers' decision-making behavior. Others have found that age does have a significant negative influence on farmers' decisions (Dolisca *et al*., 2005; Anley *etal*., 2007), though Bayard *et al*. (2007) claimed age had a positive influence. One example of the negative influence of age on farm leadership under conditions of uncertainty and limited options foundthat emotions aided young people in taking the decision to seek a satisfactory solution to such problems, such as to migrate to other farms or urban centers in search of remunerative employment or to explore other options to exploit, such as wood collection, whether they prove beneficial or not. A mixed study conducted in Haiti uncovered both positive and negative impacts of age, as young people were seen to be more willing to participate and contribute to decision-making regarding forestry programs (positive long-term decisions) in the Forêt des Pins Reserve, while the older farmerswere more interested in collecting forest resources (negative short-term decisions) (Dolisca *et al*., 2006). However, a study by Lio *et al*. (2019) in China that used rural fixed observation point data to quantify planting decisions and investment levels between elderly and younger farmers concluded that rural aging did not have a significant negative impact. Conversely, the literature on the impact of age one farmers' decision-making behavior in the Netherlands showed a negative balance in an aging community, where the young may have different preferences than living with and continuing the family farming business (Greiner and Gregg, 2006), these concerns over the succession affecting decisions on investments in the farm. These differences may be explained by the differences in contexts and preferences, whereby in some cases age does not have any influence on decision-makingbehavior, whereas in others it does.

2.4.2.2 Gender

Consideration of gender focuses on the respective social roles and identities of men and women. In household leadership in rural areas, gender is distinguished under three categories: female-headed, male-headed or mixed, where no clear indication of the household head can be obtained (Moll *et al*.,

2004). Traditionally, men are the heads of households and usually make decisions about farm management, but there is empirical evidence on gender showing that there are now many variations whereby different members of a household make different decisions regarding farming and the family at different times of the year (Zhou *et al*., 2018). A large body of empirical evidence from different countries shows that female farmers are as efficient as their male counterparts, but also that they are largely disadvantaged in terms of access to land, inputs and extension services, and are restricted in participating in decisions over farm management (Agarwal, 2018; Lioson, 2015; Meijer *et al*., 2014). Similarly, empirical evidence on gender shows that rural households are largely dominated by female heads, who contribute immensely to agricultural production, yet many farm-management decisions are made by men, who also tend to be targeted by agricultural extension services (World Bank, 2014; FAO, 2011; Moll *et al*., 2004). In Sub-Saharan Africa (SSA), for instance, female-headed households are becoming increasingly common due to crises and the exodus of young men in search of remunerative employment outside the farm. For example, the World Bank's discussion papers on raising the productivity of women farmers in SSA found that in Zambia women comprise about a third of all rural households and up to 51 percent in the Northern Province (World Bank, 1994). Such households tend to be particularly disadvantaged in respect of their landholdings, the supply of family labor and extension contacts. Gender roles in agriculture have frequently been studied by sociologists and environmental economists. Many of these studies have looked at inequalities between men and women as far as decision-making about the farm is concerned, with men playing a more dominant role than women (Asfaw *et al*., 2019; Lioson, 2015; Meijer *et al*., 2014; Zhou *et al*., 2018; Dolisca et al., 2006).

Gender inequalities are the result of social constructs in which activities, responsibilities and functions are allocated to men and women in ways that typically define their respective positions with the household, group or community. Traditionally, women have been relegated to subordinate positions as the 'mere helpers' of men, irrespective of their significant role in agriculture, where the majority of the agricultural labor force typically consists of women. The available literature on gender has documented gender inequalities particularly relating to farm-management decisions, except for one study in China that found women from 'wealthy' households were responsible for making decisions simply because their husbands have more rewarding, non-agricultural occupations and therefore leave matters concerning the farm to their wives. To a certain extent this situation may also be the same for women whose husbands working in the city and occasionally come home but frequently send money and conceded autonomy to their wives in deciding how to spend it. Such cases may, however, be very few and exceptional, as men who are the major contributors of capital for financing agricultural activities remain the dominant decision-makers (Enete and Amusa, 2010). Men's behavior may simply use heuristics frequently, even leading to better decisions, for example, using experience-based techniques both to solve problems and for farm management, or rule of thumb calculations to 'maintain and increase market linkages' or 'produce enough for household consumption'.

Despite the significant role women play in agriculture the world over, a study in West Bengal, India, found similar lower levels of decision-making by women than by men (Nilakshi, 2019), results similar to those from a study conducted by Mittal *et al*. (2018). In Bangladesh, however, Mahmuda and Yoshihito (2008) found negative participation by women in farm decision-making, similar to a study in Ethiopia by Mulugeta and Amsala (2014), who also found that most women did not have any role in farm-management decisions. In Nigeria too, gender discrimination makes women voiceless as far as influencing agricultural decisions is concerned (Kura and Yero, 2013). It is clear that gender roles are more nuanced in respect of farm-management decision-making, but these roles may be switched in times of crisis: in particular, when husbands are absent, wives in some cases have to make heuristic decisions based on experience, learning and discovery, common sense and/or imitating what other farmers do. It is expected that in difficult situations men and women jointly make decisions to find suitable solutions to managing crises. For example, in drier regions, farmers (both men and women) objectively weigh the benefits of establishing irrigation projects, calculate the costs involved and assess the feasibility of doing so with their resources or external support while also considering the benefits

of a fully-fledged irrigation scheme in the long run. Such decisions are influenced by the availability of water sources and require collective action in providing labor and locally available materials. The success of some of these initiatives lies in the support provided by donors for costly items like fencing materials, pipes and tapes.

2.4.2.3 Level of education

In the literature, discussions of the level of education mainly refer to that attained by household heads. Three levels are used to distinguish levels of education: no formal education, primary school, and secondary school and tertiary education (Moll *et al*., 2004). The literature on decision-making finds that education has either a negative or a positive influence on farm management decisions (Afsaw *et al*., 2019; Murendo *et al*., 2016; Frelat *et al*., 2016; Meijer *et al*., 2014; Pokorny, 2013; Aramyan *et al*., 2007; Dolisca *et al*., 2006). It is expected that farmers with a higher level of education have better access to information and a better cognitive capacity to calculate the costs and benefits of alternative options, while the less educated use heuristics to make their decisions. It is hypothesized that educated farmers have better knowledge of agricultural production methods and are more likely to be engaged in relationships with rural agricultural extension services. The literature on the impact of education on farm-level decision-making found mixed empirical results in terms of the level of education of different household heads (Afsaw *et al*., 2019). Other scholars found that highly educated household heads tended to specialize in high-return farm and off-farm initiatives (Asfaw *et al*., 2019; Haggblade, *et al*., 2005) compared to less educated ones who in turn are trapped into relying on low-return off-farm activities (Lioson, 2015). In a study by Asfaw *et al*. (2019), the authors found that educated Zambian farmers were more specialized in both crop production and the diversification of income sources compared to less educated Malawian farmers, who chose a lower level of income diversification. In Niger, however, the results uncovered no significant influence of education on farmers' decisions regarding either crop diversification or diversification of income sources (Afsaw *et al*., 2019). In contrast, Enete and Amus (2010) found that level of education was positively and significantly related to the size of farmers' contributions to household and community farming decisions. Others argue that the lack of formal education as a characteristic of the poorest households acts as a barrier hindering them from engaging in high-return activities, thus keeping them trapped in structural poverty (Lioson, 2015). This speaks to the relevance of education, particularly where creativity and innovation play a critical role in effectively coping with crises. Positive crop diversification was observed in a study by Asfaw *et al*. (2019) as a direct result of advice received on sustainable and productivity-enhancing practices by governments and private extension services in Malawi, Niger and Zambia. Such empirical evidence demonstrates how information provision strongly influences farmers' choices in adopting sustainable crop diversification strategies.

Enete and Amusa (2010) found a positive and significant correlation between the level of education and level of contribution to household farming decisions among women, where the highly educated were more likely to make higher contributions than the less educated. However, in reality the literature on gender documents a greater willingness among female farmers to participate in and contribute to decision-making in rural development programs compared to their male counterparts (Dolisca *et al*., 2006). This may be explained with reference to beliefs and norms, as shown in an empirical study by Britt and Shrestha (1998), who found that female farmers view forests as a source of revenue creation that helps them increase their self-reliance and gain power – hence the high rates of adoption of forestry programs by female farmers. This finding underscores the role of gender dynamics when it comes to environmental protection.

2.4.2.4 Family size

Data on family size relate to the number of persons in a given household. Regarding factors of production in African farming communities, family size is an important indicator of production, particularly as labor is pulled from within (Asfaw et al., 2019; Nhemachena and Hassan, 2007). In addition to other key factors, family size may also influence choice of activity. This is particularly true in respect of demographic data concerning the availability and amount of labor a household can

provide for both on-farm and non-farm activities. In rural settings, smaller families might find it challenging to allocate adequate labor to diversified activities, or when they have large areas of land and work is predominantly manual, or where land is limited and family members have to engage in various non-farm activities to earn incomes (Asfaw et al., 2019). It is hypothesized that the smaller the family the less labor is available and the larger the family, particularly with more adults, the more labor is available to increase income diversification and the amount of labor working in the fields.

Consistent with this hypothesis, a study by Asfaw and others (2019) showed that larger households diversified their sources of income much more than smaller households in Malawi and Zambia. However, the results in Niger by the same team were different. Also, farm households with more labor are expected to be able to adopt a number of better adaptation management practices in response to changing climatic conditions, whereas smaller households might be stuck with coping in order to survive alone (Nhemachena and Hassan, 2007). The less the labor available to the household, the more limited the household is in diversifying its sources of income and increasing productivity. However, smaller families that are also wealthier often resort to hiring seasonal labor to augment their supply of labor for agricultural activities (Ngwira et al., 2014). Family size can fall as children grow up and marry, but should sons marry and decide to continue living and working on their parent's farm, this may lead to considerable changes in household size by increasing the supply of labor (Dekker and Kinsey, 2011).

2.4.2.5 Household financial situation

The financial situation of rural households is typically a matter of rural wealth, seen in terms of having or not having money, as well as of livestock ownership. Increasingly, rural families require money for school fees, medicines, inputs, transport and many other household requirements. As such, it is important to understand the dynamics of the farm household and the comparative decisions such households make, particularly when it comes to production practices when faced with a crisis. Those with money often have a powerful social status and dominate decision-making processes within both the household and the community. It is expected that wealthier households are likely to diversify their production and sources of income and even to specialize in specific production systems (food, cash and/or livestock production) and are more likely to be able to cope effectively with crises compared to poor households.

Empirical evidence from a study by Asfaw *et al*. (2019) shows wealthy Malawian farmers venturing into specialized cash-crop production and income diversification, whereas findings regarding farmers in Niger showed wealth as having no significant influence on farmers' decisions regarding either crop production or sources of income (Asfaw *et al*., 2019). Wealthy households are expected to take advantage of the opportunities embedded in crises by choosing to become more linked to markets in order to maximize profits at low cost, for example, by switching to cash crops and/or dairy production. Others may decide to invest more in livestock, which acts as a buffer against economic and climatic shocks (FAO, 2018). According to the FAO (2018), large and small species of livestock are both flexible assets in inventories of rural wealth that can be sold in times of crisis. Depending on a household's financial situation, wealthier rural households may engage in diverse high-return on-farm and nonfarm activities with accumulation objectives that increase household incomes by maximizing the returns from their small resources (Barrett *et al*., 2001). Poor households without money are often confined to low-income and labor-intensive activities, such as working on other farms that leave them trapped in structural poverty (Losch *et al*., 2013; Haggblade *et al*., 2005). Some rural households may decide to send members of their household to urban centers or abroad as a way of generating an income. The World Bank (2008) has shown how income from remittances received from former household members helps farmers offset income shocks in times of crisis and enables the receiving households to plan and choose suitable alternative options.

2.4.2.6 Farm experience

Experience in farming is yet another relevant variable that influences decisions and management of the farming businesses of different farming households, such as decisions over whether to specialize in food or cash-crop production, or to produce for the family, the market or both. Such decisions largely depend on the number of years one has been involved in farming and the knowledge and experience one has acquired over the years. Farming experience also relates to the history of past investment on the land, the risks and how they were overcome, and the knowledge gained through experience (Jack *et al*., 2007). Here, past investment histories become important, as these tend to sharpen farmers' decisions that limit risks by making informed choices (Murendo *et al*., 2016). It is hypothesized that experienced farmers with better knowledge of their land and changing weather patterns are more likely to cope better with the climatic crisis by adopting sustainable technologies compared to new farmers with less or no such experience. This is confirmed by a study by Murendo and others (2016), in which they found that experienced farmers with information often took initiatives in adopting and testing new technologies than those without such experience. A study by Moyo and others (2012) showed that farmers with experience had a different perception of climatic conditions and rainfall variability than those without such experience. According to Murendo *et al*. (2016), farming experience relates to one's ability to acquire information on appropriate technologies, techniques and environmental conditions, suggesting a correlation with levels of education.

2.4.3 Institutions

Rural institutions consist of different types and forms of organization that facilitate decision-making and coordination among individuals and often help to reduce uncertainty regarding others' behavior. There is no universal definition of institutions, but in general terms they include organizations, markets, contracts, constitutions, cultural norms, and informal and formal rules that define rights to access goods and services and access to the management of a given space and/or its natural resources (Ostrom, 1994). From an individual's perspective, institutions may be viewed as potential benefits (resources) or as potential costs (restrictions) based on interests, perceptions and culture (FAO, 2013), or as both. Institutions can provide both incentives and disincentives to individuals: for example, the link to markets is often regarded as an economic incentive, while for individuals situated far from markets, their incentives may be more qualitative, as in improvements in standards of living, food security, happiness and increased farm assets, etc. People often come together with a strong commitment to provide one another with resources and information in order to deal collectively with, for example, risks and shocks caused by natural disasters, as well as in helping mediate rural intracommunity conflicts or to induce donors to assist them to work more effectively and collectively (Dzvimbo *et al*., 2017). It is expected that rural institutions strengthen local household's capacities to deal effectively with crises. The available literature demonstrates the role of donors' contributions in supporting and strengthening strong rural institutions by addressing some of the major obstacles to rural development in areas such as rural infrastructure and financial services (Giller *et al*., 2009; World Bank, 2008). For example, donors have helped strengthen rural financial institutions and credit unions, which in turn makes it easier for marginalized communities to access loans and credit for their farm and off-farm activities, including making long-term investments (FAO, 2013). A better understanding of how support, both financial and technical, shapes farmers' decisions and choices is important in designing effective support strategies that enable poor farmers to cope effectively with crises.

2.4.3.1 Financial support

Support plays a pivotal role in the developmental discourse, as well as the economic development of rural farming communities. In most developing countries, the major problem is with government policies and the inadequacy of financial resource allocation in supporting agriculture, in particular small-scale farmers, who are actually the major producers of food in many developing countries (Haggblade *et al*., 2010). It is expected that farmers with support are more likely to cope effectively with crises by diversifying their production and sources of income. It is also expected that farmers without support are more likely to adopt exploitative strategies merely in order to survive. The available literature shows how national governments and NGOs, often with support from the

international community, may launch multiple initiatives to support farmers with training programs, technology diffusion, the provision of small-scale credit, social payments, subsidies and investments in infrastructure and public services (World Bank, 2008). Also, private companies' investments through contract farming complement the already inadequate public extension services by engaging an extension officer specifically to serve the farmers involved (Moll *et al*., 2004). Several studies, however, show that the majority of small farmers are inadequately served by extension, advisory and research services (Dzvimbo *et al*., 2017). The manifold initiatives to support small farmers have had some impressive successes, but they have failed to hamper the ongoing process of social marginalization and environmental degradation at all significantly (Campbell *et al*. 2001). In most cases, farmers are left alone with the challenge of sustaining their livelihoods under precarious conditions (Harvey *et al*. 2014; Pokorny 2013; Wolfenson 2013) because the state has limited capacity or even the willingness to protect and mitigate the threats to local populations (Haile 2005; FAO 2010).

Empirical evidence for financial support to small farmers

A study in Northern Australia by Greiner and Gregg, (2011) identified incentives, both positive financial incentives and negative incentives through government regulation, as critical factors responsible for either motivating or hampering the effective adoption of conservation practices and the effective implementation of policy instruments. The provision of financial support has in many instances acted as a motivator for farmers' adoption of sustainable land-use systems (Greiner and Gregg, 2011). Others show mixed results, which, depending on the type of support, can be positive or negative (Pokorny, 2013). For example, Pokorny's study of Amazonian farmers in Bolivia, Brazil, Ecuador and Peru shows how short-term external support influences poor farmers in reverting back to traditional management practices after support ends. Several other examples show financial support having negative effects in the form of a low uptake of decision-support tools or new technology (Rose *et al*., 2016), low levels of implementation of water-management practices (Vrain and Lovett, 2016) and low adoption rates of sustainable land-use practices (Batjes, 2012). The availability of support for small-scale farmers varies significantly across countries, regions and communities. When combined with the availability of cash markets, it attracts households into crop diversification pathways that may result in productivity gains which in turn lift farmers from subsistence farming to trade-based agriculture, thus giving them significant income and welfare gains (Asfaw *et al*., 2019). Households with support are expected to specialize in high-return farm and non-farm activities. It is expected that the poor households without support that also have the least capacity to cope effectively with risks may engage in low-return non-farm activities to ensure their survival, reduce their vulnerability and avoid sinking deeper into poverty.

Credit institutions

Several studies have identified a lack of capital as one major constraint faced by small-scale farmers, particularly in developing countries (Ekwere and Edem, 2014). Among the reasons for the decline in the contribution of agriculture to the economy of most developing countries is the lack of any formal national credit policy and the scarcity of credit institutions that are able to assist farmers (Olagunju and Adeyemo, 2008). Agricultural productivity is reported by many authors to have drastically declinedin many developing countries, particularly in Sub-Saharan Africa, due to inadequate credit provision and poor marketing systems, with some countries having to rely on food imports and/or humanitarianaid to feed their populations (Ekwere and Edem, 2014). Many of the constraints and barriers appear insurmountable, and because poor farmers are not able to overcome these on their own, overall farming activity is limited. Against this backdrop, the Food and Agricultural Organization (FAO 2000, 2010, 2012) underscores the importance of creating credit facilities for rural populations to enable them to carry out both their farm and off-farm activities more effectively. Most poor households are forced to reduce the area of land under cultivation, as they cannot afford the costly inputs (Lioson, 2015; Dekker and Kinsey, 2011). Despite manifold efforts by governments to implement different programs to provide small farmers with inputs, they have either been insufficient or mired in corruption. In some cases, credit institutions shun lending to the small-scale farmers who make up the greater part of the farming population (Trzeciak-Duval, 2003). Over the years, credit institutions have been reluctant to finance small-scale farmers for reasons such as high default rates, the inability to

monitor many individuals whose loans do not provide much return on investment, and the lack of cost-effectiveness (Lange *et al*., 2018). Many of the poor farmers who are not supported find it difficult even to produce enough for their consumption. As a result, they may turn to other options, with possibly severe consequences for future generations (Godfray *et al*., 2010).

2.4.3.2 Extension services

The majority of small-scale farmers, who contribute between 50 and 70 percent of the global food supply in the rural areas of most developing countries, are inadequately served by extension, advisory and research services (Murendo *et al*., 2016; Meijer *et al*., 2014; Haggblade and Hazell, 2010). This lack of information in turn affects decision-making in the face of changing farming environments such as adverse weather events. With weakened extension services, the majority of poor farmers will be deprived of information on, for example, climate change and climate variability, markets and many others (Moyo and Besada, 2008). This lack of information impairs small-scale farmers' well-being and happiness, as well as making decision-making regarding what to plant, when to plant it and how much to plant difficult (Brazier, 2017). This finding is similar to the findings of Ruben and others (2006) on poor, small-scale farmers in developing countries, who face major constraints in terms of both limited resources and difficult access to markets and information, which in turn restricts their adoption of technological innovations and consequently results in their exclusion from markets. The most severely affected households are those in remote areas who are accordingly far from markets, as they may receive very little information at all, if any. It is expected that farming families with information are more likely to use it to assess the alternatives and to calculate the costs and benefits of their preferred choices more effectively than those without information. Information may also be used to diversify product portfolios for income-generating purposes, as well as to improve food security, whereas in the case of those without access to information it is expected that they may depend on selling their labor and be forced to engage in exploitative activities through their inability to sustain their subsistence needs. All farmers need effective information to implement their on-farm and non-farm activities. Without it, it may be difficult to plan and make good choices.

Institutional risk

Institutional risks refer specifically to unpredictable changes that may result in the disruption of the provision of services by institutions that support farming (FAO, 2013). Such unexpected changes may occur to both formal and informal institutions, such as banks, input suppliers, marketing organizations, government extension services and cooperatives (FAO, 2008). Also, changes in government policies that affect farmers, such as price and subsidy support, are examples of institutional risk that may cause uncertainty among poor farmers (FAO, 2013). Policy-makers make several decisions that may have a major impact on farming, such as the removal of subsidies, food-quality regulations for export crops, rules for the disposal of animal wastes and the level of price- or income-support payments (FAO, 2008). As it is common practice among human beings to try and avoid risks, an understanding of how institutional risks affect poor farmers and how these influence their decisions and choices is equally important. In the following section, a review is provided of the literature on the key institutional factors that influence farmer decisions and choices.

2.4.4 Collective action: social organization

Most rural populations in developing countries have large numbers of poor and are immersed in an environment marked by uncertainty and risk. For this reason, they often organize themselves into farmer organizations, associations, cooperatives, groups, or unions (Efendiev and Sorokin, 2013; Pokorny, 2013). Such forms of social organization are important to farmers in giving them some way of representing their interests and a means of taking collective action. This is confirmed by numerous empirical studies suggesting that rural social organization has a huge potential for sustainable economic development in rural areas of developing countries (Efendiev and Sorokin, 2013; Xu *et al*., 2013), as communities collectively decide on what they want to achieve, how and by when. Social organization is defined by Zelner *et al*. (2012) as 'networks, norms, and trust that facilitate coordination and cooperation for mutual benefit'. Efendiev and Sorokin (2013) later broaden the definition to

include 'basic norms of behaviors, social structures, values, and attitudes influencing the economic activity of a population'.

The term 'social organization' is not new (Putnam, 1995), but broadening its definition to include social, cultural, anthropological and psychological phenomena allows us to capture the many widely used popular terms to describe the social factors that influence farming economic activities (Efendiev and Sorokin, 2013). Some studies of developed countries demonstrate the important ways in which the social organization of rural communities influences their economic outcomes (Granovette, 2005). There is also frequent evidence of the successful development of farmers' organizations in emerging countries like India (Lanjouw and Lanjouw, 2001), Vietnam (Efendiev and Sorokin, 2013) and many others (Efendiev and Sorokin, 2013). Individuals working in farmers' organizations are influenced by local social contexts and traditional norms of behavior, structures, values and attitudes in their decision-making processes. For example, empirical reports from Vietnam, India and Japan show how particular local social features may influence the development of social groups in conducting similar economic activities (Efendiev and Sorokin, 2013). Similarly, in China, the literature suggests that traditional values, cultural features and social relations may be the basis for a strong and successful social organization (Farh *et al*., 1997)). China's traditional social organization of informal institutional systems based on kinship solidarity (Farh *et al*., 1997) is similar to the traditional African social organization of close-knit systems also based on kinship solidarity and mutual support. Such informal institutional systems, if broadened and strengthened, would induce local and international support enhancing the improvement of productivity among socially organized communities. For example, a study of Amazonian farmers shows that the majority of smallholder families were organized into associations, cooperatives and unions, which influenced them in collectively taking advantage of emerging opportunities for commercialization and support (Pokorny 2013). Several empirical reports in the literature show the influence of social organization on rural community's decision-making processes, which has provided a boost to rural economic farming in some parts (Xu, *et al*., 2013; Farh, *et al*., 1997), as well as on managing risks and providing social protection (FAO, 2017). In developed countries such as England and Denmark, Cloupkova *et al*. (2003) found that farmers' organizations play an important role in rural economies and that these organizations have grown over time to become part of rural social and economic life (Christensen, 1983).

Heterogeneity of rural farmer organizations

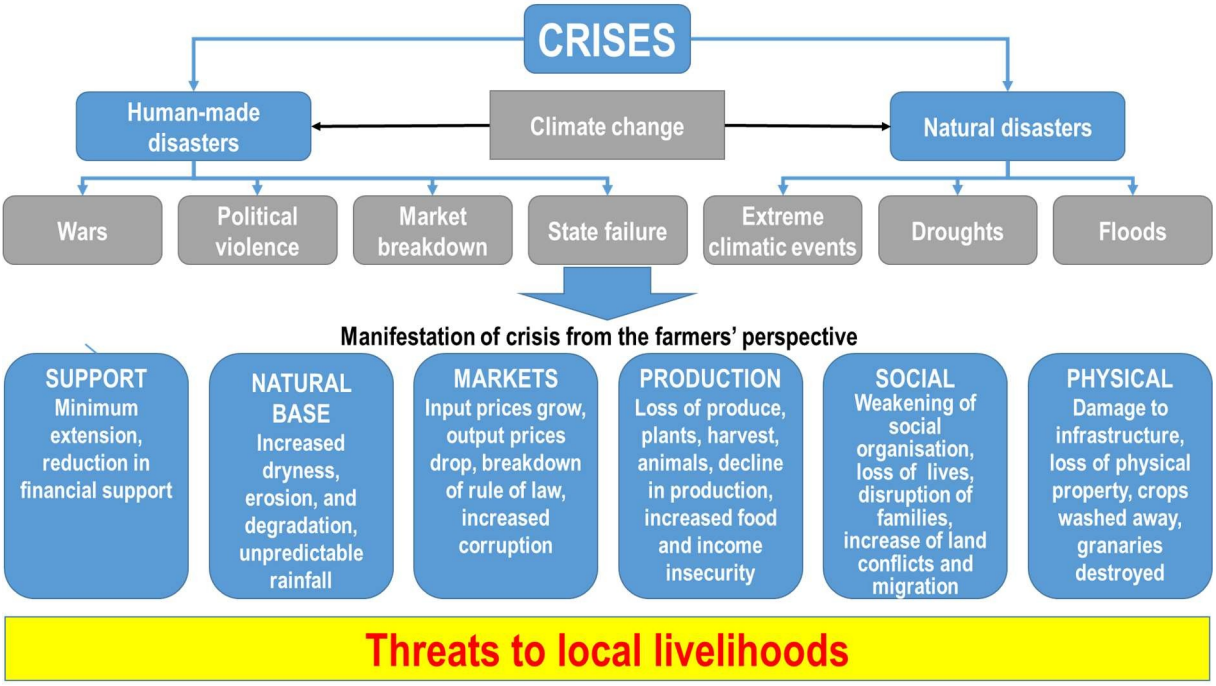
There are wide diversities between farmers, and there has been an increase in the number of scientific studies documenting their heterogeneity with regard to the impact of agriculture and rural development (Lanjouw and Lanjouw, 2001). Farmers differ in asset endowments and in how they choose to allocate their assets across numerous activities in order to generate streams of benefits that can be either qualitative or monetary in form (Barret *et al*., 2001). Qualitative benefits are often seen with improvements to well-being, food security and the use of sustainable production methods. In the same way, socially organized groups are not homogenous: some tend to be strong and others weak, signifying the social, cultural, anthropological and psychological phenomena found in different rural settings (Lovenda *et al*., 2004). Some studies have shown that different local characteristics in social organization and traditional elements of rural social organization may either weaken or strengthen the establishment and maintenance of farmers' organizations (Efendiev and Sorokin, 2013). However, on a more positive note, Anderson (2007) found that through social organization smallholders have taken on the role of 'developmental catalysts'' in developing countries, mainly in the areas of health, education, industry and agricultural development. As development catalysts, farmers can identify and mobilize rural synergies and leverage local resources and networks to find solutions to local issues, thus fostering sustainable growth and community development while promoting and improving information exchange and sharing best land-use practices.

2.5 Conceptualization of farmers' responses in times of crisis

For effective analysis of the vulnerable contexts of small-scale farmers' responses to crises, a conceptual framework was designed (Figure 4) which matches the methodological approaches

adopted in analyzing crises. It shows how crises affect farmers' decisions, as well as the factors that influence their decisions, and the varying local responses of farmers in coping with crises. This conceptual framework was prepared using the four research objectives and hypotheses as reference points in conducting the research, which was carried out in consecutive phases that enabled systematic data collection, codification and analysis. In the preliminary phase of the research, the case studies to be used for the field research were identified using the criteria of accessibility, representativeness of semi-aridity, tenure regimes, production and environmental diversity among farmers. It was during this phase that different categories of crises, farmers, factors and farmers' responses to crises were established. In the second phase, data were collected tracking historical changes from 2000 to 2016, as well as from the farmers identified in each of the four case studies, the factors that influence their decisions and their responses to crises. These data helped in identifying the categories of crises that affected them, the factors that influenced them the most and the proportions of farmers' responses in the different contexts. Also, using systematic data-gathering, in this phase the study identified and assessed the relevance and feasibility of the range of locally evolved responses to crises and the underlying rationalities. In the third phase, an assessment of the various factors and conditions that influence farmers' decisions and choices was carried out. Of these three phases, more data were obtained on the extent of the crises and its impact on farming conditions. Different farmer categories were established, together with farmers' responses and the factors and conditions that either support or hinder effective action in times of crisis.

Figure 4. Conceptual framework of farmers' decisions in times of crisis



There is empirical evidence showing how the state has responded to crises over a period of sixteen years. The state's way of responding to a crisis is usually to reduce support to public institutions and to withdraw finance needed for the effective implementation of, for example, extension services, healthy delivery systems, schools, etc. This reduction in support by the government often increases corruption and weakens rule enforcement.

The available literature also illustrates how crises has become the norm in many African countries. To understand the impacts of crises on farmers' responses, analysis is needed of the different disasters that rural populations are exposed to and how these are manifested from the farmers' perspective. In this case, three reasons for crises were identified: man-made disaster, natural disasters, and climate change, which scientists agree is aggravated by human activities (IPCC, 2019; Schiermeier, 2018). Comparing the existing literature with the reality in the study areas, the former illustrates how man-

made and natural disasters, including climate change, threaten the local livelihoods of poor farmers, particularly those located in marginal areas of semi-arid regions. In the case of climate change, other studies have methodically examined human activities, which in turn contribute to the quickening of global warming and the changes in climatic conditions farmers perceive over time that help explain and interpret the findings of what is already known and/or gained from new insights. The existing literature shows how farmers perceive changes in weather patterns in the form of rainfall variability, extreme heatwaves, extreme temperatures, increased and prolonged dry spells, shorter winter periods, shorter rainy seasons and other extreme climatic events (Braizer, 2017). On the one hand, four categories of man-made disasters were identified: wars, political violence, market breakdown and state failure. While this list is not exhaustive of man-made disasters, it includes specific man-made disasters that have a bearing on the livelihoods of poor farmers in Africa. Several analyses have examined the causes of climate change and the threat it poses to the livelihoods of local people, particularly those living in arid and semi-arid regions (Braizer, 2015, 2017) due to lack of water. Scientific evidence shows that extreme weather events are increasing in number and intensity, making hot areas hotter and wet areas wetter, as a result of climate change (IPCC, 2019; Braizer, 2017). On the other hand, an analysis of natural disasters like droughts and floods, whose frequency and intensityhave also increased over the decade and have become common disasters in Africa, pose great threatsto the local livelihoods of rural farmers. The dynamic interplay between man-made and natural disasters has increased the risks to, vulnerability of and uncertainty among farmers, while their resilience and ability to adapt to changing conditions are also challenged. To understand the dynamicinterplay between man-made and natural disasters, analysis of the manifestations of crises from the farmers' perspective is of paramount importance. These manifestations of crises can be grouped under six categories: support, natural base, markets, production, and social and physical aspects.

A review of the literature on African countries shows how many of them have been damaged by past wars and sometime present-day conflicts, as well as assessing the causes and consequences of these events (Straus, 2012). The motivation and reasons for political violence in Africa are many, but in most cases, they center on the question of power, as a majority of politicians practice rent-seeking and cling to political power through a system of patronage (Mutondi, 2010). Using such systems, political leaders corruptly distribute public resources, contracts and jobs to their cronies without recourse to formal rules. Corruption lies at the heart of the problem, and when corruption is so rampant, the state becomes an integral part of the problem. Other causes of political violence include inequalities of income or deprivation and repression by the regime, which often emerges from a deep-rooted political culture of intolerance, revenge, antagonism and arrogance (White, 1992; Muller, 1985). Political violence may also be triggered by political non-cooperation and stalemates between the ruling party and an opposition party, as when election results are contested. While political differences are common in most countries, in some countries such differences degenerate into violence, while in others they do not (Maundeni, 2012).

Scientific studies show that over the last decade in Africa there has been a consistent decline in warfare, including large-scale mass killings of civilians; however, war remains the continent's greatest challenge (Straus, 2012). This decline in warfare has been replaced by other forms and patterns of political violence that are increasing and persistent in Sub-Saharan Africa such as electoral competition and conflicts over livelihood resources (Straus, 2012). Election-related violence has been reported from Malawi to Madagascar, Kenya to Nigeria, Ghana to Uganda, Cameroon to Ethiopia, Côte d'Ivoireto Guinea, and Senegal to Zimbabwe. Such violence tends to set back the economic recovery process of most farmers, as in some cases people abandon their crops and livestock during politically motivated violence, which seems to reoccur with each election cycle in many countries (Kimenyi *et al*., 2014).

The manifestations of wars and political violence have devastating effects, socially, physically and negatively affecting farmers' productivity, market operations and support, increasing the insecurity of affected countries. Pragmatically, communities' social fiber may be torn, resulting in the weakening of social organization, which is critical for collective action, particularly in responding to crises. Families

are disrupted, abducted, mutilated and even killed. In situations like these, it is only logical that international non-governmental organizations (NGOs) withdraw their support in affected regions and move to safer areas, which in turn results in the breakdown of contracts and cooperation, leaving poor farmers the hardest hit (Kimenyi *et al*., 2014). Studies also demonstrate the link between insecurity caused by political violence in terms of the rise in conflicts over land, corruption, breakdown of the rule of law and the increased vulnerability of rural poor farmers (Matondi, 2010). In terms of corrupt activities, the available literature examines the roles of bribes and extortion, which often are pervasive among law-enforcement agents, resulting in turn in the breakdown of the rule of law, as enforcement becomes a challenge (Williams, 2019). In terms of support, the literature highlights the amount of extension and financial support that is available for rural farmers in times of crisis (FAO, 2017). It is also important to understand the influence of fiscal challenges, such as falls in foreign aid, foreign direct investment and remittances, and their impact on poor rural farmers, who in any case often lack financial support from banks when they do not have any assets or collateral acceptable assets (FAO, 2002). The available literature also sheds light on internal displacements and migration, arguing that these disrupt families socially, particularly when it comes to reducing the available household labor and ultimately the household's productivity (Hathaway, 2019). Physically, the destruction of food stocks is increasingly used as a tactic of political violence and civil conflicts in which crops, livestock and food reserves are plundered or burned and production is reduced through the destruction of farm assets, the denial of access to fields and the involvement of young people in violence in return for payments (FAO, 2017).

According to the FAO (2017), the affordability and accessibility of agricultural inputs, food prices in the market, the demand for food and commodity production in output markets, and the fulfilment of contracts between farmers and private companies, as well as cooperation with international development organizations (NGOs), are all often affected by crises. The available literature on markets shows that during crisis periods agro-dealers are not able to deliver agricultural inputs of improved seeds and fertilizers safely (FAO, 2017). Wars and political violence often disrupt the whole value chain, from farmers and agro-dealers to transportation and traders (Kimenyi et al., 2014). It is therefore, clear that the need for peace, rule of law, and good governance is pivotal for normal food production. At the farm level, farmers' productivity may decline due to the non-availability of inputs and labor shortages, as families are disrupted, with some deciding to migrate, but farmers may deliberately lower production levels as price increases for inputs become unavoidable, while demand for certain commodities might also fall in crises (FAO, 2006). It might also be difficult to work in the fields, from which farmers may be cut off, making it impossible for them to produce their crops. Agro-dealers may find it difficult and at times dangerous to deliver agricultural inputs to affected areas, and should they decide to stop producing or move to safe areas, this will result in supply shortages and/or price rises for inputs (FAO, 2017). At times inputs may be available too far away for farmers to be able to access them.

Climate-change studies analyze changes in weather patterns, particularly the increase in the intensity of droughts and extreme conditions, and how these threaten the livelihoods of local communities (FAO, 2008; Braizer, 2017; Bhatasara, 2017). Changes in weather patterns, which include rainfall variability, heatwaves and other extreme weather events such as droughts and floods, have been shown to affect seven dimensions of farmers' lives: social, physical, production, markets, support, climatic conditions and insecurity (FAO, 2008). As several scientific studies have suggested, climate change poses a huge threat to the livelihoods of many poor rural family farmers. This study focuses on marginalized farmers, that is, subsistence, contract or small-scale farmers (the majority of African farming communities), more than 95% of whom in Sub-Saharan Africa depend on rain-fed farming but are faced with growing uncertainties caused by changing climatic conditions (Abrams, 2020).

The consequences of both human-induced and natural disasters cut across all seven categories listed above, although some manifestations may be stronger in certain categories than in others, forexample, in terms of physical and social manifestations, floods, wars and political violence, which tend

to contribute strongly to damage to infrastructure, the loss of physical property, the loss of lives, mutilation, disruption of families, the weakening of social organization and increases in migration tendencies. The failure of the state is often manifested through the rise in insecurity evidenced by an increase in land conflicts, corruption and the breakdown of the rule of law, but it can also be manifested across all the other six categories. Droughts, like floods, wars and political violence, manifest themselves by reducing farmers' production, but they become much stronger especially with agricultural or mega-droughts where produce, plants, harvests and animals are lost, indicating an acceleration of environmental degradation (IPCC, 2019; WIRFs Water, 2015; IPCC, 2012). Market manifestations are influenced by man-made and natural disasters as well as climate change in terms of determining the prices for agricultural inputs and food, the demand for commodities and food types, and the breakdown of contracts and cooperation (FAO, 2017; Kimenyi *et al*., 2014). While wars and political violence pose a great threat to security, their consequences are found in all the seven categories identified in this study.

3 THE CASE STUDY

To determine how farmers responded to the situation of crises (political, economic and environmental), this thesis analyzed four case studies in rural Zimbabwe, a prime example of a country in crisis. Case-study research has several definitions (Gustafsson, 2017), the main components of which are in-depth investigation, descriptive and exploratory analysis, and intensive, systematic investigation of complex phenomena in their natural setting to increase understanding of them (Heale and Twycross, 2017). This thesis draws on the definition by Yin (2000), who defined case studies as 'an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially where complex interactions between humans and the environment are evident'. Case studies (1) are often stronger and more reliable than research into a single case whose results might be generalized, despite each case having its own reality, and (2) use several cases allow for a more comprehensive exploration of research questions and theoretical development (Stake, 2006). Thus, choosing four case studies permitted an in-depth understanding of the chosen examples by comparing the similarities and differences between the individual cases. As is typical of most case studies, there was no desire to generalize from one case to another, nor was it the intention to study any of the selected cases to understand the others; rather, I examined each case in order to understand it in itself (Thomas, 2013). The research process was undertaken over four years and included a series of field visits to explore the dynamics and the driving forces underlying the cases over a fifteen-year period by combining quantitative and qualitative methods (Thomas, 2013).

3.1 Zimbabwe

In the immediate post-independence era from 1980 to the 1990s, Zimbabwe was able to produce enough to feed both its own people and the wider region (Rukuni et al., 2006). Then, in 2000, Robert Mugabe, the then President of Zimbabwe, spearheaded a process of radical land reform. Most striking, so-called large-scale commercial farms (LSCF) were forcibly taken from about five thousand white farmers who had previously occupied the best lands located in the most suitable agro-ecological regions, with high rainfall patterns. These farms, which existed under private property rights, were historically the center of commercial agricultural production, having backward and forward linkages with the manufacturing and services sectors, and constituting the backbone of the agricultural and economic system in both Zimbabwe and southern Africa generally. The former white farm-owners did not receive any compensation, their land being parceled out to new owners, mostly government officials, military and security agents, and politically connected individuals, as well as ordinary people. This process was violent, and blood was shed, resulting in the internal displacement of thousands of people, including white farmers and their former workers. The land-reform process received widespread condemnation from the international community.

The land reform program was a turning point in Zimbabwe's post-colonial history. From an economic point of view, land as a key factor of production was disturbed, with ripple effects along the whole of the agriculture value chain. Production of and markets for food crops, cash crops, livestock and timber, among other commodities, were significantly disturbed. The result was increased food insecurity in both grains and livestock, falls in the supply of commodities to the manufacturing industry and as a result the collapse of secondary industry, which provided a market for agricultural commodities for processing. Likewise, supplies of agriculture-related inputs also collapsed. Employment in the agricultural sector and in industry dropped, as did incomes, resulting in increased poverty. Parallel institutions and services linked either backwards or forwards to commercial agriculture collapsed, notably the financial sector and extension services. The effects of this agricultural crisis, induced by the land reform, were aggravated by the world food crisis of 2003/08 and world economic crisis of 2008/09. The impact in Zimbabwe was devastating. From 2000 to the present (2021), the country has been suffering political instability, bad governance and policy inconsistency (Raftopolous, 2013), as well as an economic meltdown leading to a crisis of liquidity and a cash crunch (RBZ, 2015; GoZ, 2007).

At the political level, Mugabe's regime became increasingly authoritarian, with increased politically motivated violence targeting anyone who voiced concern over the land issue or had any different

political opinion. Successive and multiple election fraud was committed in 2000, 2002, 2005, 2008 and 2013, the rule of law was debased, and dictatorship and indiscriminate human rights violations under the heavy militarization of state institutions and increased insecurity became the norm. At the social level, poverty increased, and there were collapses or other failures of social delivery services such as water provision, leading to the cholera outbreak of 2008/09, health services at the time of the HIV and AIDS pandemic, schools and education systems, and road and transport services. The result was increased social unrest, domestic violence and large-scale out-migration by ordinary people seeking greener pastures beyond Zimbabwe's borders.

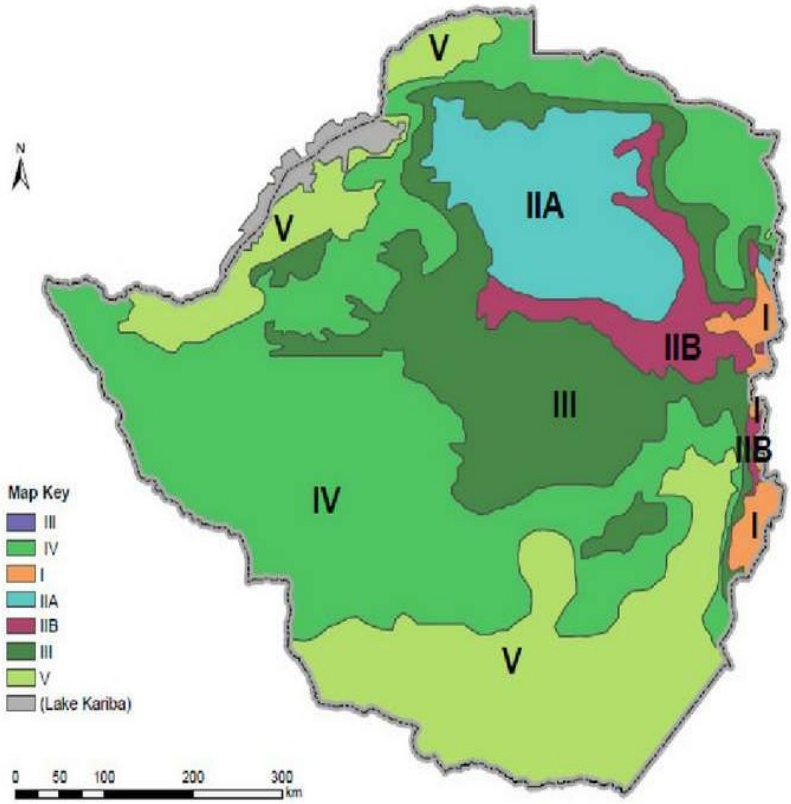
This situation was compounded by climate change. Starting with the devastating El Niño cyclone in 2000, the country experienced an increase in the number and intensity of droughts, floods, extreme heat waves and high temperatures, together with changes in rainfall patterns and other extreme events (Brazier, 2017; FAO, 2017; Gähler, 2016). An agrarian crisis in the early 2000s born out of the failures of the new, inexperienced and unsupported farmers (Scoones, 2014; Moyo et al., 2009; Dekker and Kinsey, 2011) and a food crisis that rendered the country a net food importer (Moyo and Chambati, 2013), from previously being a 'breadbasket' of southern Africa, were other consequences.

Despite all these challenges, agriculture remains the cornerstone of the Zimbabwean economy, contributing approximately 17-20% to annual GDP (FAO, 2019; Maiyaki, 2010). About 70% of the countries' population directly depend on agriculture for their livelihoods (Maiyaki, 2010; Gambiza and Nyama, 2006). The agricultural sector provides employment and income to some 60-70% of the population, supplies 60% of raw materials to the industrial sector and contributes 40% of total export earnings (RBZ, 2018; FAO, 2019). Agriculture is a key determinant of rural livelihood resilience, since more than 70% of the population depend on it, but with the steady decline of the country's economy, a sharp decline in productivity, the closure of industries, increases in unemployment rates, the increased scarcity of foreign currency and high rates of inflation have been experienced for more than a decade. These economic downturns have negatively impacted on the delivery of public institutions such as extension services, banks and health services. The debilitating effects of the unprecedented political and economic crisis in Zimbabwe, including the impact of climate change, all threaten the local livelihoods of poor farmers, especially those located in semi-arid regions. Coincidentally, the majority of farmers in Zimbabwe live in semi-arid regions commonly referred to as natural regions III and IV (Figure 5), which are only suitable for semi-intensive farming (Moyo, 2000). The total land area of these two natural regions accounts for more than half Zimbabwe's total land area, and about 70% of the farming population resides in these regions.

Figure 5 gives details for the five different agro-ecological regions found in Zimbabwe, where green represents water availability well above normal rainfall; lime green areas receive normal to above normal rainfall; orange represents a mixture of high temperatures, heavy rainfall and dryness; dark orange indicates dry semi-arid regions, with rainfall characterized by severe dry spells during the rainy season; and red areas are the very dry areas, with very erratic rainfall.

In Zimbabwe, the small-scale or smallholder sector constitutes 98% of the total farming population and occupies about 75% of the total agricultural land. The medium-scale sector constitutes about 2% of the total farming population and occupies about 7% of agricultural land, and large-scale commercialfarmers nowadays make up only 0.4% of the total farming population on about 10% of agricultural land (Bvudzijena, 2009; Pazvakavambwa, 2009). The medium- and large-scale commercial sectors arewell-financed, highly capitalized and mostly produce crops and livestock on a large scale for profit. Information on these capitalized sectors can be easily accessed from the Agriculture and Livestock surveys conducted annually by ZIMSTATS and agricultural data from the Ministry of Lands, Agriculture and Rural Resettlement (MLARR). Conversely, the smallholder sector, on which this study focuses, is not financed or capitalized and is inadequately served by research, advice and technical services.

Figure 5. Zimbabwe's natural regions



Natural Region	Total area per region (000 ha)	Total land area (%)	Annual rainfall (mm)	Farming systems
I	613	1.56	>1.000. Rain in all months of the year, relatively low temperatures	Suitable for dairy farming, forestry, tea, coffee, fruit, beef, and maize production
IIa & IIb	7 343	18.68	700-1.000. Rainfall confined to summer	Suitable for intensive farming, based on maize, tobacco, cotton, and livestock
III	6 855	17.43	500-800. Relatively high temperatures and infrequent, heavy rainfalls subject to seasonal droughts and severe mid-season dry spells	Semi-intensive farming region. Suitable for livestock, fodder crops and cash crops production under good farm management
IV	13 010	33.03	450-650. Rainfall subject to frequent seasonal droughts and severe dry spells during the rainy season	Semi-intensive region. Suitable for farm systems based on livestock and resistant food crops. Forestry, wildlife, and tourism
V	10 288	26.2	<450. Very erratic rainfall. Northern low veldt may have more rains but the topography and soils are poor	Extensive farming regions. Suitable for extensive cattle ranching. Zambezi Valley is infested with tsetse fly. Forestry, wildlife, and tourism

Source: Adapted from Marongwe (map), Moyo, 2000; Vincent and Thomas, 1961

3.2 Case studies

The study covered three small-scale farming sectors out of four. These were the communal lands represented by two case studies (community in intact and impoverished landscapes), small-scale farms and the A1 farm model as a resettlement area. Not covered is the Old Resettlement Area (ORA), consisting of farmers resettled in the early land redistribution program from 1982 to 1998. The cases were selected by following the criteria of representativeness for semi-arid regions regarding farming practices, quality of resources, accessibility and rainfall regimes. Four villages were selected as case studies (Figure 6), each located in a district representing typical semi-arid contexts in Africa regarding tenure regimes, farming practices, quality of resources and accessibility. The selected case studies are located in the natural regions II, III and IV. These regions contain seven different farm-size categories, from which three cases have been selected for this study, comprising small-scale farms, resettlement areas and communal areas (Table 4).

Table 4. Farm size categories per agro-ecological region

Type of farm	Sub-categories	Farm sizes as per agro-ecological regions in hectares					
		I	IIa	IIb	III	IV	V
Communal (customary system) *	Residential and field plot	0.1-3	0.1-3	0.1-3	0.1-3	0.1-3	0.1-3
	Grazing	-	-	-	-	-	-
Resettlement area (A1 model and the Old Resettlement Area 1980-1997) *	Residential and field plot	6	6	6	6	6	6
	Grazing	-	-	-	-	-	-
Small-scale commercial farms (SSCF)*	Combined residential, field and grazing	230	30	40	60	120	240
A2 model	Combined residential, field and grazing	250	500	500	700	1000	2000
Medium-scale commercial farm	Combined residential, field and grazing	100	200	250	300	700	1000
Large-scale commercial farms	Combined residential, field, and grazing	250	500	500	700	1000	2000
Peri-urban	Combined residential, field and grazing	2-50	2-50	2-50	2-50	2-50	2-50

Source: Government of Zimbabwe (2001) and various FTLR research reports
** denotes selected case studies based on farm size*

The communal areas are the smallest, with an average farm size of 0.1-3 hectares. These form two of our case studies. The farms in the resettlement areas are of medium size, with an average of six hectares, in comparison to the large farms, with an average farm size of 40-240 hectares. Medium-scale commercial farms were not considered in this study. Farm sizes in communal areas are much smaller than all the other farm types together with access to common grazing areas. Information on the size of grazing areas was not readily available, nor for resettlement area A1 farms. Two of the case studies fall into the category of communal areas: that is, communities in intact and impoverished landscapes. Medium-size farms are roughly double the size of small farms in communal areas, with an average landholding of six hectares per household, and have access to common grazing areas. Large farms are significantly larger, measuring between 40 and 240 hectares in the case of self-contained farms. The A2 model, showing medium- and large-scale commercial farms, was not included in this study, as these are highly capitalized, supported farms with annual data available from Ministry of Lands, Agriculture and Rural Resettlement, the Commercial Farmers' Union and ZimStats.

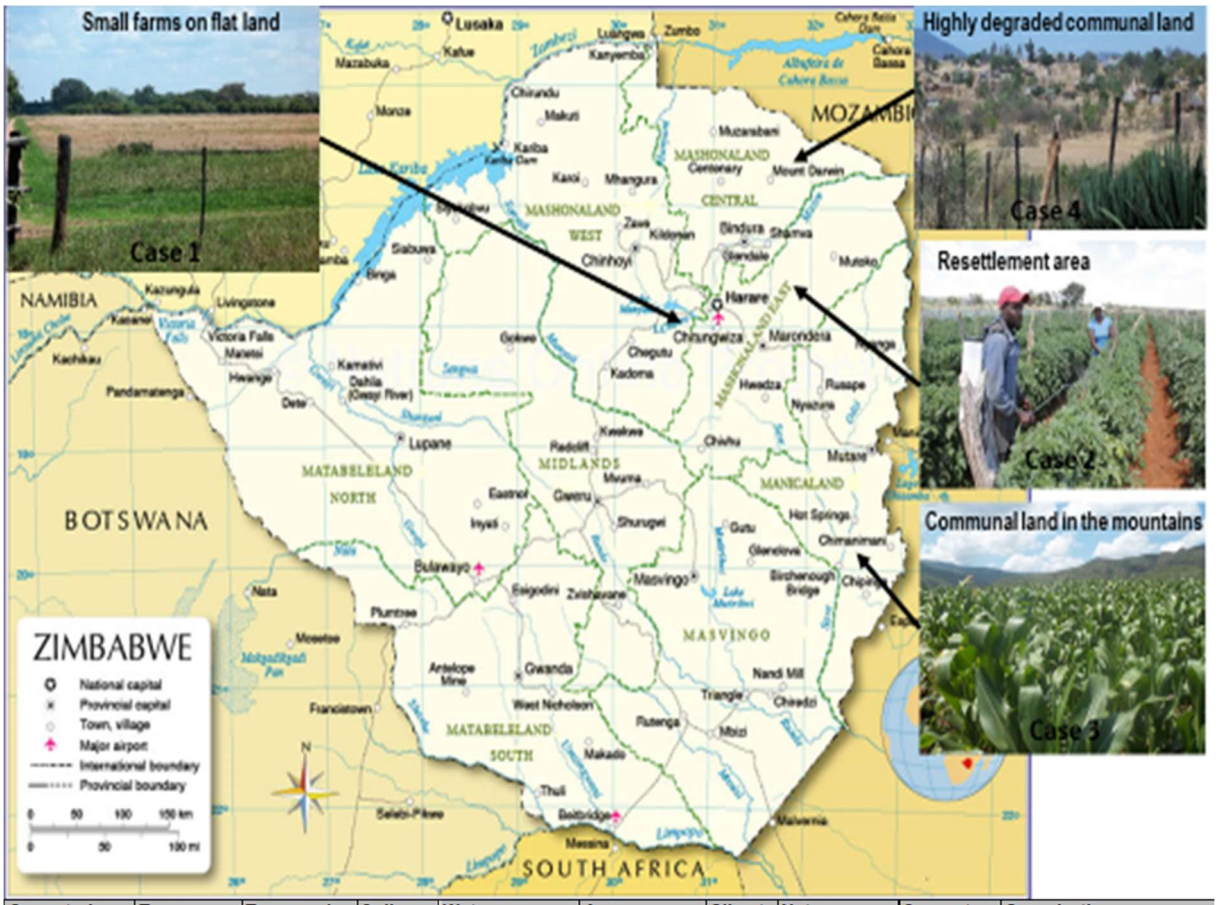
To find village case studies that were representative of the prevailing agro-ecological zone and farm types in Zimbabwe, we approached researchers, governmental officials and local representatives, as well as focal persons from organizations with which the researcher had personal and institutional relations, more specifically Caritas Mutare and Chinhoyi. These both form part of the development arm of the Catholic Church in Zimbabwe and are supported by Misereor. In each of the suggested villages, an exploratory visit was undertaken to acquire a general impression of the specific manifestations of crises, farmers' responses and influential factors. For the municipal ward of Marirangwe North, the entire ward comprising sixty households with self-contained farms were included. In the three other case studies, only one municipal ward was visited, consisting of several villages with many households (Table 5).

Table 5. Demographic data on the case studies

Case study	Accessibility	Name and (numbering) of ward	N villages of the ward	Number of households	
				Surveyed	Total
Small-scale farms	Focal person and DA	Marirangwe North (no number)	No village	60	60
Resettlement area	Focal person and DA	Unnamed (18)	8	120	332
Communities in intact landscape	Institutional arrangement	Mhakwe (18)	6	120	1030
Communities in impoverished landscape	Institutional arrangement	Kandeya (19)	16	120	1393

To gain access to two of the case studies, District Administrators (DAs) were approached to define access possibilities and draw up a work schedule. This process was so bureaucratic that the work schedule for these case studies had to be adapted several times. The DAs provided contacts for the councilors in the identified areas, and the councilors provided the researcher with contacts for the village heads in the case of the resettlement area and a focal person in Mariangwe North, the small-scale farm case study.

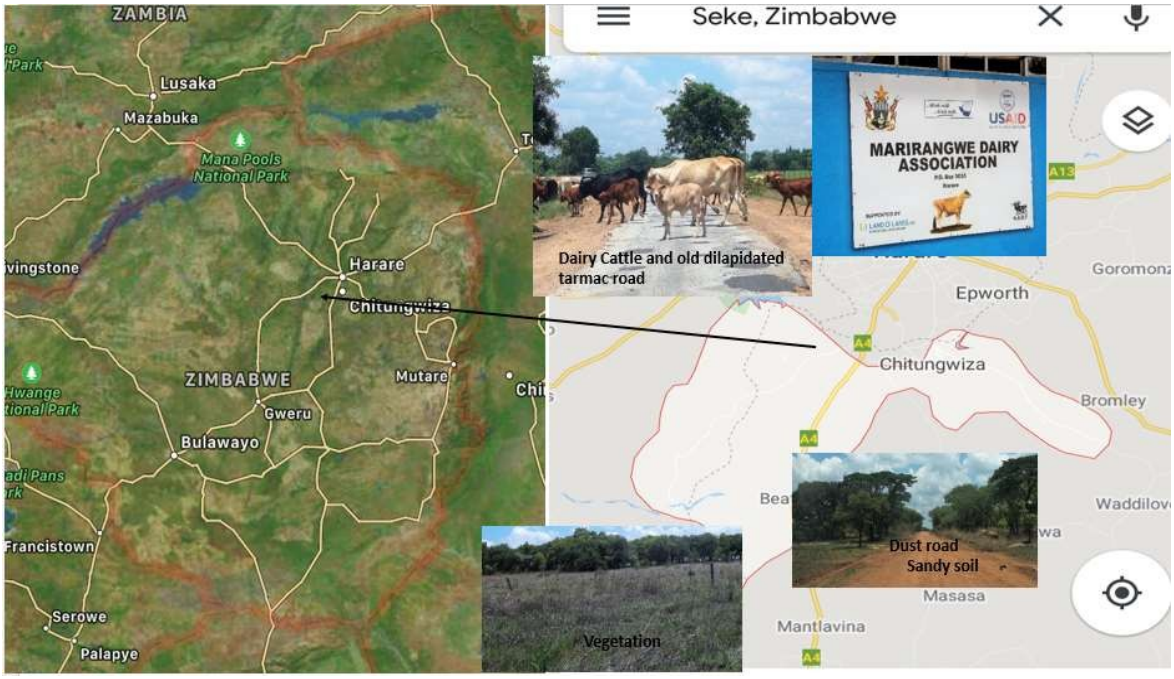
Figure 6. Localization and characteristics of the case studies



Case study	Tenure	Topography	Soils	Water	Access	Climate	Nature	Support	Organizations
Small-scale farms	Individual formal	Flat	Infertile sandy soils	The high groundwater table, perennial rivers	Proximity to the capital city – Harare	Semi-arid	Thick forest and woodlots	Minimum private and external support	British American Tobacco, Mashonaland Tobacco Co., Land O' Lakes International, STABEX, Large commercial farmer
Resettlement area	Individual formal user rights	Mountainous	Infertile sandy soils	Perennial river, dam, boreholes, receive above-average rainfall	Proximity to the capital city – Harare	Semi-arid	Woodlots and vegetation cover	Minimum private company support	Mashonaland Tobacco Co., government (during election periods)
Communities in intact landscape	Communal / collective informal	Mountainous	Infertile sandy soils with gravel	Abundant mountain water reservoirs	Remote with poor road network connecting to the highway	Semi-arid	Woodlots and vegetation cover	Moderate external and local support	Miserior, Caritas Denmark, LEAD, World Vision, Caritas Mutare, Mutserendende, TSURO, Windows of Hope, Environment Africa
Communities in impoverished landscape	Communal collective informal	Hilly and mountainous	Infertile sandy soils with gravel	Water scarcity, dry river, dams and wells, low water table	Far from Harare but close to Provincial town. Poor roads	Semi-arid	Degraded landscape with uncovered soils, bare valleys	Minimum external and local support	Miserior, World Vision, Mashonaland Tobacco Co., Hear Africa, EMA. FACHIG, SAT

3.2.1 Small-scale farms near markets

Figure 7. Map and features found in small-scale farms in Seke District



The 'Small-Scale Farms' case study is a more traditional site comprising medium to small-scale farmers with landholdings ranging from 60-240 hectares. The farmers are organized in a dairy association. The historical background to this area is that the farmers acquired land under the 'Native Purchase Areas' provisions, which was established as a result of the 1930 Land Apportionment Act, following the 1925 Morris Carter Commission recommendations. The Native Purchase Areas were designed to compensate Africans who were barred from owning land outside the reserves. Accordingly, they were given the option to buy newly demarcated properties that had mostly been farmed by early settlers, but were of poor quality (Scoones et al., 2018). As farmers in this area own their own land, they are most likely to invest more in land and in protecting the natural resource base on which they largely depend. Also, due to the existence of comparatively large properties, it can be expected that farmers diversify their crops commensurate with the land they have. The area is flat and characterized by infertile sandy soils and a semi-arid climate, with thick forests and woodlots on most farms, and it has a high groundwater table, which allows farmers to irrigate their crops all year round. They also have access to a permanent river, the *Manyame*, from it's the periphery of which farmers can draw water to irrigate their crops. The area is located in the relatively wet Natural Region III. Farmers in this area are specialist food and cash-crop producers who mostly grow long-season crop varieties. This study site is situated in Seke district in Mashonaland East Province and is located in close proximity to the capital Harare. However, the road network is in a dilapidated state, though every rainy season the road is repaired using a grader, which makes the area more easily accessible and keeps transportation costs relatively low. Due to their proximity to major markets, the farmers can access both input and output market using relatively cheap transport and have better access to public extension services, which increases their choices concerning alternative crop and livestock management practices. The majority of the farming community in this area are second- or third-generation farmers, having inherited the farm from either their late or their surviving parents. Accordingly, they have vast experience in living and working on the farm from childhood. The international development NGO, Land O' Lakes and STABEX provide technical and financial support for dairy farming. Land O' Lakes focus on improving agricultural practices and markets, leading to better incomes for farmers and their families, stronger agricultural businesses and industries, and more resilient and secure communities. The area has a well-maintained infrastructure that comprises a primary and a secondary school, a clinic and a business

center, and every farm is connected to electricity. There are sixty households whose livelihoods depend on agriculture.

3.2.2 Resettlement areas near markets

Figure 8. Map and feature of Ward 18 in Goromonzi District

Farmers in this area are beneficiaries of the major land-reform program of 2002. There were basically two distribution models: the so-called A1 farmers, who were allocated six hectares; and A2 farmers, who were allocated larger tracts of land varying from fifty to two thousand hectares. The latter was designated as medium-scale commercial farms whereas A1 model was meant to resettle landless farmers mostly from communal areas. In the case study, the majority of the farmers had received less than six hectares (Moyo, 2011). Depending on natural regions, grazing areas are common, as is the case with communal farmers. While some farmers have self-contained A1 farms, the majority are in villages, and their fields are in designated areas. The farmers in the resettlement case-study comprise war veterans, civil servants, educated business people and landless people from communal areas. When they settled in the area, the majority were taking their first initiative into farming, and as such could be characterized as inexperienced. The area is mountainous, with infertile sandy soils, a permanent river, two dams and several boreholes that were drilled by the former white landowners. The area lies in Natural Region IIb, which receives 750-1000 mm of rainwater annually. As a wet region, farmers in this area specialize more in food and cash-crop production and are expected to grow mostly long-season crop varieties. The forests are rapidly depleting principally due to the production of tobacco, which largely depends on wood for curing. Most of the farmers in this area own cattle as one source of wealth, but pastures in the area have declined due to repeated allocations of land in areas previously set aside for grazing. This case study is located in the Goromonzi district of Mashonaland East Province and is close to the capital city, Harare, but the road connecting the area to the main markets is in a dilapidated state, and no efforts are being made to rehabilitate it, as the community largely works individually. The settled farmers only occasionally receive government support (every five years when there are elections), but here private-sector organizations such as the Mashonaland Tobacco Company (Pvt) Ltd and the Tobacco Industry and Marketing Board (TIMB) also provide inputs, extension services and markets for tobacco production. Despite the support given for tobacco production, such cropping is a risk business considering the ongoing anti-tobacco lobby which is gaining momentum globally. Financial advisors also made a stance that new generation of investors will not want to invest in tobacco hence the need to identify and support alternative niche crops other than

tobacco. In the absence of infrastructure development support from the government, farmers turned the former white commercial farmers' house into schools. There is no clinic or business center in the area, therefore farmers must travel to the nearby Goromonzi rural district township for health services at the local clinic that serves its population, including the surrounding resettlement areas. This study focused on Goromonzi ward 18, which comprises eight villages with 332 households whose livelihoods largely depend on agriculture.

3.2.3 Community in intact landscape

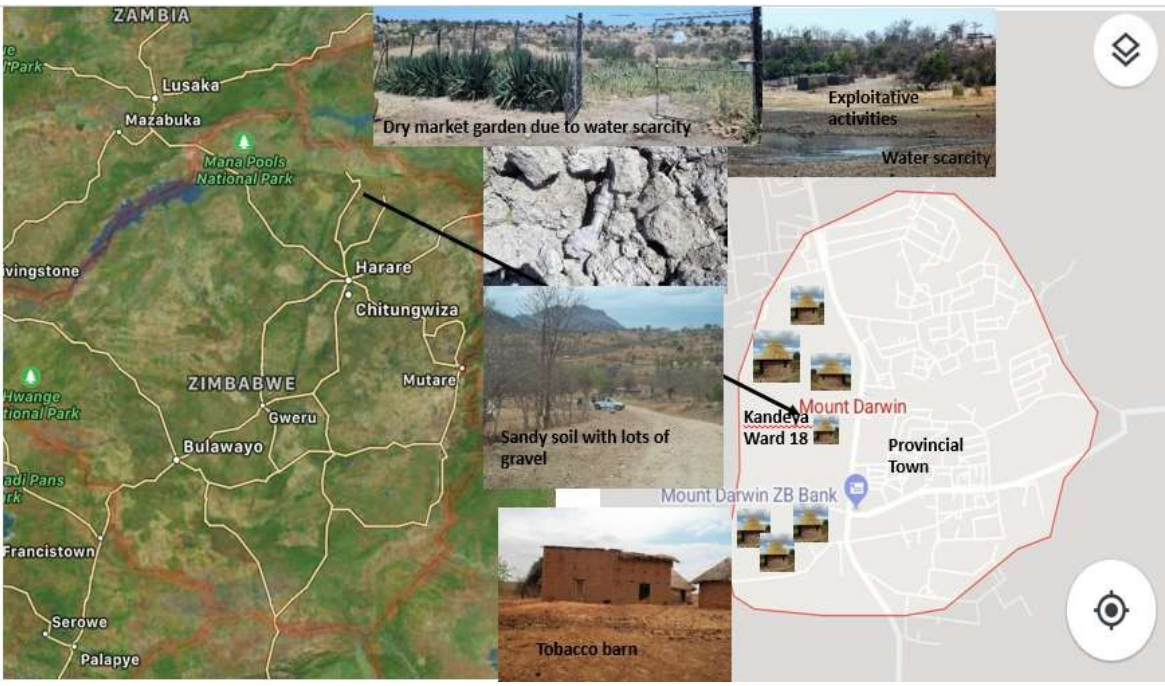
Figure 9. Map and features of Mhakwe Communal area, ward 18 in Chimanimani District

This case study describes a typical traditionalized communal area in Zimbabwe where farmers practice communal ownership and work together collectively on the basis of joint land-use decisions. The case study is situated in Chimanimani district of Manicaland Province, a mountainous area characterized by infertile soils with lots of gravel. It is located in Natural Region IV, which is dry, and farmers are forced to adopt drought-tolerant varieties as well as technologies to conserve both soil and moisture. Most fields are terraced, and several water reservoirs on the tops of mountains provide gravity-fed water for irrigation. In total six irrigation projects have been established with outside financial support from Misereor, Caritas Denmark, the European Union and World Vision. The area is located on the eastern highlands of Mutare city, about 143 km away on a highway, but the road connecting it to Mhakwe Ward 18 is a rough, bumpy, gravel dust road, which makes transportation costs very high, as hauliers cite fast wear and tear, from which they cushion themselves by charging more. The area has an intact landscape with moderate forests and woodlots within individual farm areas and surrounding forests. Another common feature in this area is the baobab trees, an indication of its dryness. Villagers often collect the bark and use it to weave hats, baskets and mats as a way to raise some income. Farmers also harvest baobab tree-leaves and fruit for their own consumption and for sale, as both are regarded highly nutritious. Farmers in this area receive moderate external support from international cooperation organizations like Misereor, which, through Caritas Mutare, a local Church-based NGO, provides support to promote irrigation, sustainable land-use practices and animal husbandry. There are also several community-based organizations operating in the area, including organizations like Mutserendende, TSURO and Windows of Hope. Another important feature of this case study is that several households are organized into farmers' groups working on both irrigation and dryland

agriculture. Additionally, Environment Africa has provided support for farmers' groups to establish apiculture as an income-generating project. In total there are six villages comprising 1098 households that depend largely on agriculture for a livelihood.

3.2.4 Community in an impoverished landscape

Figure 10. Map of Kandeya Ward 19 case-study in Mt. Darwin District



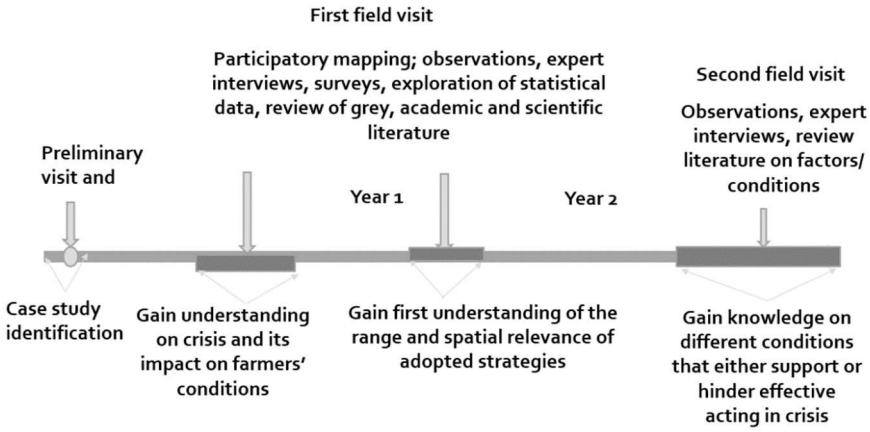
Like the former case study, this one is an area informed by communal ownership. The principal difference, however, is that in this site and the landscape have become highly degraded over time. Kandeya ward is situated close to Mt. Darwin provincial town in Mashonaland Central Province, some 158 km from the capital Harare. The area is mountainous and is characterized by infertile sandy soils with gravel. The climate is semi-arid and, during the dry season, the river and dams in the area dry up. The problem of water scarcity is aggravated by human activity along the riverbank, such as the establishment of market gardens and mineral panning, which chokes the river and cause siltation. Accordingly, farmers have to use drought-tolerant crop varieties, as well as technologies to conserve soil and water moisture. The land and mountains lack trees because people systematically cut them down for firewood, selling and treating tobacco leaf. The roads connecting Kandeya Ward to the nearby provincial capital are bad, and there is no public transport plying the area except for private cars. The farmers in this area receive minimum private-sector support. The Mashonaland Tobacco Company (MTC) is active in providing inputs, extension services and markets for the cultivation of tobacco. Like case study 3, Misereor, through Caritas Chinhoyi, provides support to promote irrigation, sustainable land-use practices and animal husbandry. Some short-term financial support has also been made available by Hear Africa, a Christian Organization of the Salvation Army, for the construction of a clinic in the area. World Vision provided agricultural inputs in 2010, and the Environmental Management Agency has provided financial support for the establishment of income-generating projects such as apiculture. In total, there are sixteen villages in Kandeya Ward 18 and 1393 farming households.

3.3 Data-gathering

This study applied a mixed-methods approach using both qualitative and quantitative methods, supplemented by data gathered through expert, group and individual interviews, participatory mapping exercises, participant observation, field walks, surveys and secondary data sources such as government statistics and the minutes and reports of farmer associations and NGOs, in so far as they

were accessible. Field research was implemented in three phases (Figure 11), their specific methodological criteria and procedures being outlined in this section.

Figure 11. Field research plan



3.3.1 Exploratory field visits

In phase one, the selected cases were visited to establish personal relationships and to gain an initial overview of the key conditions that were relevant to the research. For the case studies of 'small-scale farms' and 'resettlement area', intensive interviews were conducted with representatives of the Rural District Council (RDCs), organized by the Municipality Ward Councilor and the village heads. In the other two cases, representatives of the Caritas Zimbabwe diocesan offices in Mutare and Chinhoyi were interviewed, as well as Rural District Administrators (RDAs), local leaders, extension officers and lead farmers. For each case study, field visits were announced in advance.

3.3.2 Intensive field research

The second phase of the research included intensive field visits in which mixed qualitative and quantitative methods were used to collect data in order to meet two essential objectives: (1) to gain an understanding of how crises has changed the conditions under which the farmers live, and (2) to grasp the range and spatial relevance of strategies adopted by the farmer collective in response to the changed conditions. To learn about crises, the reasons for it and how it manifested itself, expert interviews were conducted with local leaders such as the village heads, the municipal ward councilors and two chiefs, the latter also helping trace the history of crises in Zimbabwe in more general terms. Sources consulted included government and international reports, non-governmental agencies, local NGOs, climate-change response plans and public research organizations like the Zimbabwe National Statistics Agency or ZimStat and the Environmental Management Agency or EMA, Environment Africa). In addition to the expert interviews, a review of the literature was conducted particularly to reveal insights into the Zimbabwean crisis (Table 6). Through these activities, indicators were identified and assessed in order to describe the extent of the change and the range of strategies adopted by the farmers in the case studies (Table 6).

Table 6. Indicators explored in expert interviews about the manifestation of crises from the local perspective

Disaster type	Indicators	Authors
Failure of state	Weak rule-enforcement	Human Rights Watch, 2008
	Corruption	Transparent International, 2015, BTI, 2018
	Land conflicts and oppressive and repressive laws	Mutondi and Dekker, 2011, Alden and Anseeuw, 2011
Political violence	Increase in intimidation, brutality, abductions, killings	Sachikonye, 2010
Breakdown of markets	Costly inputs, low output price	Dekker and Kinsey, 2011; FAO, 2003
Climate change	Increase in heatwaves, extreme temperatures, dryness	IPCC, 2019, Gähler, 2018
Natural disasters	Increase in the number and intensity of droughts and floods	IPCC, 2012; 2019; Gähler, 2018

Crisis indicators included the level of conflicts over land, corruption, the costs of agricultural inputs, the prices for agricultural output, the demand for certain crops, the level of rule enforcement and the social situation. Concerning climate change and its impacts, the indicators included extreme heat waves, extreme temperatures, rainfall patterns and droughts. At a later stage, most of the experts listed above were invited for a participatory mapping exercise to describe the areas, assets and locations of the properties and discuss their characteristics regarding accessibility, fertility, water and other natural-resource endowments. This exercise culminated in the production of site maps drawn by the participants.

To establish farmer categories, in-depth data on who is doing what, where and under what circumstances were collected through household surveys and group interviews. In particular, group interviews enabled the discussion of meaningful possibilities to differentiate between farmers, as well as to sketch the range of strategies adopted by the farmers and their underlying rationales. Information about production systems and social and economic networks was also collected in the household surveys. As the numbers of farmers were large and the farms quite distant from each other, individual interviews concentrated on the lead farmers and the extension agents. In Zimbabwe, lead farmers play a central role in the organization of communal areas (case studies 'community in intact landscape' and 'community in impoverished landscapes'), whereas in the case studies 'small-scale farms' and 'resettlement area', it was the extension agents and village heads respectively who coordinated village affairs. Table 7 provides an overview of the scope of the partners selected for the intensive expert interviews.

Table 7. List of intensive interviews with individual experts in the case studies

Case study	Focal person	No. of households per focal person	Total of represented households
Small-scale farms	3 Extension officers	20	60
Resettlement area	8 village heads	15	120
Communities in intact landscape	8 lead farmers	15	120
Communities in impoverished landscape	10 lead farmers	12	120

In addition, interviews were conducted with representative of local key institutions (Table 8). These interviews served to double-check and consolidate the information from the expert information, as well as to explore in more detail the modes and level of interconnectedness among farmers, economic cooperation, trust, and intensity of communication among farmers.

Table 8. List of backstopping interviews with representatives of local organizations in the case studies

Case study	Key institutions	Number of interviewees
Small-scale farms	Marirangwe Dairy Association	16
	Extension officers	2
Resettlement area	Group comprising: head of village heads, village heads, secretaries and councilor	21
Communities in intact landscape	Mhakwe irrigation	10
	Nechirinda irrigation	8
	Dembweni irrigation	6
	Lead-farmer group	5
	Two nutrition garden groups	10
	Internal Savings and Lending Clubs	21
Communities in impoverished landscape	Kandeya irrigation	18
	Lead-farmer groups	10
Total		**112**

In addition, statistics and records kept by the dairy association and farmers' groups, Internal Savings and Lending Clubs (ISACs), local NGOs and extension agents were reviewed. This was done primarily to identify relevant quantitative data on crisis conditions, farmer types and responses, but also to find

about meetings and agreements that indicate relationships and the level of cooperation among local actors.

3.3.3 Complementing and consolidating data

This phase essentially invested in understanding the factors and conditions that influence farmers' behavior and choices. Households were surveyed to learn about their characteristics at the personal level (household size, head, level of education, financial situation, farm experience), the farm level (assets, size, land tenure, remoteness) and the institutional level (extension services, financial support, social organization). Additional, semi-structured interviews were conducted with two farmers who were identified as typical proponents of each of the identified response strategies to crises to learn about the operational details of their livelihood strategies, the underlying rationales of the decisions they made and the effects of the adopted strategy. In total, 120 households (30 households per case study) were visited. The interviews were also used to document observations and statements by the farmers about their situations, which helped the general process of interpreting the data.

3.4 Data analysis

The gathered data were analyzed to find responses to three essential questions: (a) How have the conditions for the farmers changed as a result of the multiple crises since the year 2000? (b) How did farmers (individually or collectively) responded to changed conditions? And (c) What factors influenced decisions regarding the chosen strategies? To elaborate on these responses, an interpretive approach was applied, which is underpinned by the observation and interpretation of events and interpreting information so as to arrive at meanings and to understand the meanings that the case-study data suggested (Aikenhead, 1997; Deetz, 1996). More specifically, the interpretive approach was particularly useful for understanding human beliefs, motivations and thought processes (Neuman, 2004). It included a constant process of comparison, which is considered to be the basis of interpretative research (Thomas, 2013). As such, a constant comparison was conducted by re-examining collected data over and over again, comparing the various elements (rural socio-ecological actors, conditions, the environment, social and economic activities, changes) and the other elements (core strategies before and during crises, rationality, relevance, effects). The aim of this procedure was to grasp the full complexity of human sense-making and the subjective reasons and rationalities that lie behind farmers' actions in times of crisis (Kaplan and Maxwell, 1994). To establish a starting point for this interpretative approach and to support it, the study also applied descriptive statistical methods to explore the relevance of the identified core strategies adopted by small-scale farmers in response to crises and the factors of influence. Moreover, to ensure the trustworthiness of the research, triangulation was used.

3.4.1 Organization of data

In a first step, all information and data on the case studies, manifestations of crises, case studies and households generated through the various methods were documented and loosely attributed to the three research objectives. Then the basic information was coded and processed into an Excel file. Case-study characteristics basically included data on location, distance and tenure regimes. In addition, for each case study, general aspects were described concerning the mode of social organization, the level of water availability and relief (Table 9).

Table 9. Case study sub-regions

Case Study	Key features	Code
small-scale farms (case 1)	Individualized, dry, flat land	SG1
resettlement area (case 2)	Individualized, dry, mountainous, ground and surface water in dams	SG2
community in intact landscape (case 3)	Collective, dry, water sources in mountains	SG3
community in impoverished landscape (case 4)	Collective, drier, gold deposits, streams and rivers	SG4

Households were classified in relation to their livelihood strategy and their responses to crises. In addition, the principal features describing the farms and the households were noted (Table 10).

Table 10. Classification of farmer types

Farmer type	Coding	Farmer description
Subsistence farmer	SF	Orientated towards subsistence farming to produce food for the family
Concentrated farmer	CF/IF	Intensive farming on smaller plots of land with high yields
Tobacco farmer	TF	Produce tobacco for the market, often combined with some food crops
Milk farmer	MF	Produce and deliver milk to milk-collection center
Livestock producer	LP	Orientation towards livestock production, including cattle (as a crucial farm asset) and small livestock (chickens, goats)
Diversified farmer	DF	Produce a variety of food and cash crops
		Diversification through remittances and remunerative jobs in urban centers or other farms
		Diversification through exploitation

The study distinguishes six farmer types. The first type includes farmers oriented towards subsistence farming; the second type consisted of farmers who embarked on intensively managed pieces of their land; and the third category was for those who oriented themselves towards markets. Then we had farmers who engaged in the production of tobacco, milk or livestock, the latter differentiated into two subtypes: cattle and small livestock. Finally, there is a category of farmers with diversified production, either by cultivating a variety of crops (intercropped, separately, or rotational in irrigation schemes), or relying on off-farm jobs and remittances, or involved in exploitative land uses.

The classification of farmer's responses to the situation of crisis distinguishes seven principal response categories and various subtypes (Table 11).

Table 11. Classification of farmer responses to crisis

Response category	Code	Sub-category	Code
On-farm			
Subsistence orientation	SO	Meet household needs	MHHN
		Produce surplus	PS
Concentration	CP	Strong concentration - increase yields	SC
		Weak concentration - food-insecure	WC
Market orientation	MO	Tobacco production as main income source	TP
		Milk production as main income source	MP
Livestock orientation	LO	Milk cows	MC
		Cattle - rural wealth	C
		Small livestock production to improve food and income	SLP
Diversification of production	D	Diversification of crop production	DC
Off-farm			
Diversification through jobs and remittances	DJR	Remunerative employment	RE
Diversification through exploitation	DE	Wood collection - income source	WC
		Illegal mining - income source	IM
		Streambank cultivation - nutrition and income source	SBC

For farmers with a subsistence orientation, two subtypes were coded, one for those who produced only enough to meet their family's needs, the other for farmers who were able to produce a surplus, at least in a good season. Farmer households that adapted to crises by reduction, concentration and intensification were divided into those with a strong trend towards concentration and those with weak concentration. Farmers with an orientation towards markets were divided into three subtypes, oriented respectively towards tobacco, milk and maize. In terms of livestock orientation, farmers whose core strategy was skewed towards small livestock production were differentiated from those who concentrated on cattle. Also, two subtypes for diversification of production were used: households that diversified crop production, and those that diversified income sources. In terms of off-farm strategies, diversification through jobs and remittances covered those who sought remunerative employment outside their farm, including those who had migrated and could send remittances back to the remaining family members. Those who diversified through exploitation were differentiated into three subtypes: households that engaged respectively in wood collection, illegal mining, and stream-bank cultivation with the conversion of wetlands into agricultural land.

3.4.2 Quantitative analysis

This study used descriptive statistics to describe the basic features of the data gathered. Unlike inferential statistics, which attempt to infer from the sample data what the whole population is doing or make generalizations, descriptive statistics simply describe the realities found in each selected case study. Descriptive statistics can be used to present quantitative descriptions in a manageable form (Blaikie, 2003) and to provide simple quantitative measures, such as percentages, or visual summaries, such as tables, charts and graphs, including histograms. They are also used to describe a single variable (univariate analysis) or more variables (bivariate/multivariate analysis). In the case of this study, a multivariate analysis was used to analyze the influence of the various changing conditions on farmers' behavior and choices in times of crisis. Descriptive statistics were used to describe the population (number of farmers doing what, where, and under what conditions) using tools such as percentages, frequency tables, distribution tables, correlation matrices, Probit regression and decision trees for every farmer response. To elaborate descriptive statistics on changes to farmer types in the period of the study and the responses of the farmers to crises, and to make statistical comparisons of the influence of case-study and household features on these changes and strategies, we imported the Excel data into R to apply the R Markdown program from R Studio.

First, we generated descriptive statistics and frequency tables for household categories and characteristics and responses in each of the four case studies, as well as in total. Both household characteristics and responses were coded using the lowest number to express negative, small or no answer, and high numbers to depict a positive, large or yes answer. Some variables were treated as nominal data and others as ordinal data. Ordinal data implies that the different values can be sorted in an order. Nominal data provide names not in any order. More specifically, we identified households with and without farm assets, small and large farm size, low or high levels of conflicts over land and being near to or far from markets. Personal features of farm households included presence of young or old farmers, whether male or female-headed households, whether educated or not educated, poor and wealthy households, and farmers with and without farm experience. Concerning the institutional aspects, key indicators included households with or without financial support, minimum extension services, existing economic or social networks, and households that work individually. Similarly, farmer types and response categories were included. Table 12 lists all the variables that were considered in the statistical analysis.

For the nominal data only frequencies were provided, whereas for the ordinal data we also calculated minimum, first quartile, median, third quartile and maximum. Also, the interquartile range was calculated as the difference between third and first quartiles.

The next analytical step was to examine the correlations between case study, farm and farmer features regarding how the farmers in the case studies responded to crises. In the case of strong inter-correlations between two variables, there was considered to be only one in the model because the second one does not provide much additional information. The Spearman correlation coefficient was used to allow consideration of the variables on the ordinal level (*niveau*). At the heart of the analysis was the modelling of probit regression of all the responses. Probit regression for the ten responses and decision trees was provided.

The level of statistical significance was expressed as a *p*-value less than 0.05 written as ≤ 0.05 as indicating strong evidence against the null hypothesis. A *p*-value higher than 0.05 (> 0.05) was considered not statistically significant and therefore as indicating strong evidence for the null hypothesis. The study took cognizance of the fact that a statistically significant result does not automatically prove that the research hypotheses are correct, as this implies 100% certainty. Therefore, the author states the study results as 'providing support for…' or as 'giving evidence for…' the research hypothesis. This then covers the probability that the results may have occurred by chance, making the null hypothesis correct, for example, less than 5%. The exact *p* values are reported using

the American Psychological Association APA, 2010 style: for example, *p* values less than .001 are reported as *p* = .001, and *p* is always italicized with spacing on either side of the = sign. The term 'non-significant' is used as the opposite of 'significant'.

Table 12. List of variables considered in the statistical analysis

Variables	Data type*	Coding classification
Farm assets	OD	1=without assets, 2=with a few assets, and 3=with assets
Farm size	OD	1=small, 2=medium, and 3=large
Land tenure	OD	1=freehold; 2=leasehold, and 3=customary
Remoteness	OD	1=further markets, 2=nearer markets
Age of household head	OD	1=20-35 years, 2=35-55 years, and 3=above 55
Gender of household head	OD	1=male-headed, 2=female-headed (absent husband), and 3=female-headed (no husband)
Education of household head	OD	1=less educated (primary school), 2=educated (Form II), and 3=highly educated
Family size	OD	1=small, and 2=large
Financial situation	OD	1=poor HH, and 2=rich HH
Farm experience	OD	1=less experience, and 2=more experience
Extension services	OD	1=minimum access, and 2=reasonable access
Financial support	OD	0=without, 1=with
Social organization	OD	0=No, 1=Yes
Response coding		
Subsistence-orientation	ND	0=No, 1=Yes
Concentration	ND	0=No, 1=Yes
Strong concentration	ND	0=weak, 1=strong
Financial support	ND	0=No, 1=Yes
Market orientation	ND	0=No, 1=Yes
Market type	ND	0=No, 1=tobacco, 2=milk, 3=maize and or wheat
Strong market connection	ND	0=No, 1=Yes
Livestock orientation	ND	0=No, 1=dairy cows, 2=cattle, 3=small livestock
Diversification of production	ND	0=No, 1=Yes
Diversification through jobs and remittances	ND	0=No, 1=Yes
Diversification through exploitation	ND	0=No, 1=Yes
Other variables considered as nominal data		
Case study feature 1	ND	Case-study features: individualized and collective
Case study feature 2	ND	Flat, mountainous, water sources and drier
Farmer type in 2000	ND	
Strong market connection	ND	
Farmer type in 2016	ND	
Major response	ND	

**OD=ordinal data, ND=nominal data*

3.5 Research ethics

All prospective participants were informed fully about the nature and purpose of the study, including the fact that it was an academic study with no prospects of changing their lives. Participants in this study gave honest responses to the research questions and were neither coerced nor coaxed to participate. Their consent was solicited, and the researcher explained that they would not be paid to participate. None of the participants in the four case studies requested payment; in fact, they saw the research as a platform for sharing their experiences and their stories. The majority of the participants commended the researcher for looking into the issue of livelihood struggles in times of crisis. In Goromonzi, one village head asked for compensation in cash or through the provision of food during group interviews, but he was reminded of the earlier explanation that no payment would be made so as to avoid comprising the integrity of the data. This village head decided not to participate, and the

researcher disqualified him for fear that he could embellish his responses. The reasoning behind the disqualification of this particular village head was based on the principle that responses that are elicited voluntarily are more reliable.

In all four case studies, participants were asked permission to record the interviews on audio equipment. This caused most of them to object, and they intimated that they were not comfortable about being recorded. As a result, the researcher used a notebook and diary to record the interviews. Some participants pointed out that they were afraid of making political comments or statements that may later land them in trouble in a country where freedom of expression is limited. The researcher assured them that their responses would remain anonymous and confidential. The research also asked permission to take pictures and to use them solely for the purposes of the study. Permission to do so was granted except in case study 2, where informants cited a fear of having their pictures taken, and so no pictures were taken in this area. Based on the fears expressed at the proposals to make audio-recordings and take photos, throughout the interviews the researcher avoided questions that would reveal the participant's identity. As such, any names mentioned in this thesis are pseudonyms, and their farm areas and other personal details are not provided.

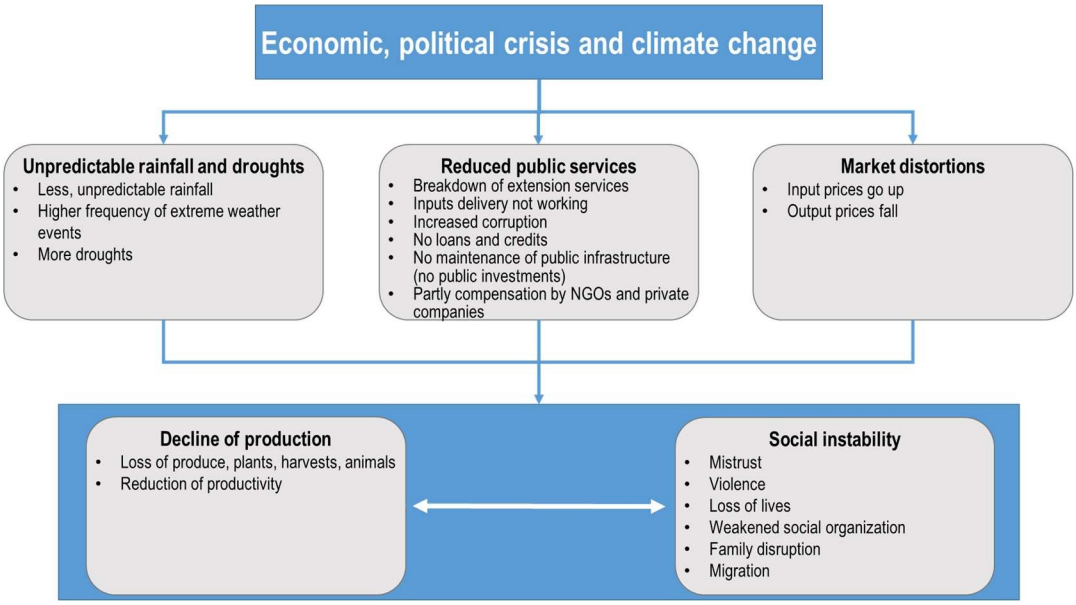
4 RESULTS

This chapter presents the findings of the study in three subsections: (1) local manifestations of the Zimbabwean crisis, (2) farmers' responses to the crisis, and (3) influencing factors.

4.1 Local manifestations of crisis

This section describes their perceptions in this regard and the effects of crises in the four case-study areas. A large number of crisis manifestations was observed that were highly relevant to the life of the farmer. Farmers were suffering from unpredictable rainfall and drought, the breakdown of public services and major market distortions that in turn provoked a decline in production and social instability (Figure 12).

Figure 12. The interlink between local manifestations of crisis



4.1.1 Reduced public services

Breakdown of extension services

The Zimbabwean crisis manifested through the reduction in public services (health, education, etc.). Most devastating from the farmers' perspective was the *breakdown of extension services* in terms of both quality and quantity. The gradual reduction in government spending after the introduction of the Structural Adjustment Programme (ESAP) in 1991 led to budgetary cuts to the Department of Agricultural, Technical and Extension Services (AGRITEX), which had serious implications for its operations. This resulted in a reduced number of field experiments, demonstrations, field days, discussion-group meetings, training sessions and even awareness-raising activities, which were particularly affected. With just one field agent per ward from 2000-2004, the workload became too heavy as mobility became poor, making it difficult for the agent to offer the service to all the farmers in the ward. Also, the previous training schemes for farmers with limited resources or support given to farmers to solve their own problems and support agricultural development were also negatively affected in some cases, being halted completely or offered only piecemeal. Farmers also felt that there was now a shortage of new knowledge or information to transfer to them, also reflecting the decline in the quality of extension services rendered to farmers. This was mostly attributed to the failure to provide the continuous learning of existing extension officers in an ever-changing environment. The quality of extension work was also affected by the serious transport problems and a cut in travel and subsistence budgets to ensure reasonable coverage of all areas by senior and village-level agents.

The government realized this shortage and in 2005 started efforts to restore the number of extension agents to three per municipal ward level. However, while this number was achieved in many wards, this effort did not reap the best results. It is evident that land resettlement without effective and continuous extension services is a disaster. The technicians appointed had little motivation due to their

meagre salaries, the lack of transport facilities and the absence of any professional perspective because of the lack of opportunities to train further and achieve qualifications. With a huge wage bill and a struggle to pay public-sector workers on time, the government resorted to cutting budgets and stopped maintenance of the motor-cycles used by the agents and other facilities. As a result, the services provided to the farmers gradually deteriorated even more. Extension agents resorted to serving only farmers close to where they lived, while others started to demand transport from farmers requiring on-farm technical and advisory services. In such difficult situations, it was not always easy or possible even for farmers with cars to meet the agents' demand, but the situation was even more critical for poor farmers without the means to pick up and drop the agents. Unlike before the Zimbabwean crisis, when extension agents would visit all farmers, during the crisis some farmers located far way in remote areas reported not having accessed extension services for the past five years. This was particularly the case for farmers located in the case studies 'resettlement area' and 'intact and impoverished landscapes', characterized by mountainous areas that were difficult to access.

Some agents responded to these difficult working conditions by seeking rents from farmers for services rendered. This was mostly reported in the 'resettlement area' case study, two villages in which also reported that they did not know their extension agents. To confirm the breakdown of such crucial services, the two villages made reports to the District Extension Officer and the Rural District Administrator, but no action was taken against the agents, who were on pay role but were not providing the farmers with any services. These farmers were left on their own with their difficult situation, without the information they needed to cope effectively with changing climatic conditions and markets. These farmers reportedly used previously acquired information, while others were said to have reverted to using indigenous knowledge systems, especially for pest management, and at times imitating others.

Input delivery not working

Most striking was the failure of the **input delivery** system, through which government is supposed mobilize funds to support inputs, which anyhow did not work (Table 13). Millions of dollars of public funds went through the government to support small-scale farmers, but farmers reported having not received this support.

Table 13. Government's mobilization of support to farmers in 2000 to 2016

Financier	Farming season	Amount	Purpose
Government of Zimbabwe (GoZ)	2016/17	US$15 million	Command Agriculture, contract system between farmer and the government. Meant to produce 2 million tons of maize on 400,000 ha
The European Union (EU) and GoZ	2011/12	US$100 million	Input support scheme for 800,000 communal farmers
	2011/12	US$75 million	Input scheme for both commercial and communal farmers
GoZ	2009/10	US$210 million	Input scheme - heavily subsidized inputs
GoZ	2008/9	-*	Targeting 500,000 ha of intensive maize production & 12,500 tons of seed
GoZ	2005/6	ZW$15 trillion (US$2,5 trillion)	Production of 2,250,000 tons of maize, 90,000 tons of tobacco, 750,00 tons of horticultural produce, 49,500 tons of maize seed, 210,000 tons cotton**
Presidential scheme through well-wishers	2004/5	ZW$10 million (US$1,6 million)	Emergency input intervention scheme for 190,000 Households
GoZ	2002/3	ZW$8,5 billion (US$1,3 billion)	Input credit scheme
Private sector	2002/3	ZW$35 billion (US$5,6 billion)	Input credit scheme
GoZ	2001/2	ZW$15 billion (US$2,4 billion)	Input credit scheme
Agribank	2001	US$2,1 billion	Loan facility to new farmers***
GoZ	2002	ZW$60 billion (US$9,6 billion)	Loan facility raised through the sale of agricultural bonds by the country's financial institutions

**No figure obtained. **Government failed to raise the money. ***Reportedly looted, with little production having been recorded.*

The process of input delivery to farmers was biased, as inputs were delivered along partisan lines. Interestingly, funds for input delivery to farmers were mobilized almost every year, but farmers reported only having received inputs at election time. Farmers also reported that input delivery was often done very late and in very small quantities, which for many did not help much. Input delivery was heavily marred by corruption in many cases, ending up in the wrong hands of those who did not deserve it, who received inputs at the expense of deserving farmers. Consequently, non-farmers who acquired inputs quickly sold the inputs (seed and fertilizers) on the black market at unaffordable prices. As well as the input delivery-coded 'input scheme' there was a farm mechanization program, which again was greatly affected by corruption and the long arm of the bureaucracy, resulting in none of the farmers from the four case studies benefiting from a tractor or any other machinery and equipment that the program provided.

In addition to the public funds listed above, the study found that several donations from different countries had been made available through the government to revitalize the agricultural sector, particularly the small-scale sector (Table 14). This support consisted mostly of farm machinery and equipment.

Table 14. External support to reviving agriculture in Zimbabwe

Country	Year funding was approved	Amount in US$	Machinery and equipment
Japan	2002		200 tractors during the first two years of the land reform program*
Belarus	2001		2000 tractors; several combine harvesters; 700 tons of fertilizers
Iran	2004	US$15 million facility	400 tractors
Malaysia	2004	US$10 million facility	25 tractors; 50 seed drills; 15 combine harvesters; and 500 tons of fertilizers and other agricultural chemicals
USA	2002	US$1 billion facility	Humanitarian assistance and agricultural projects
Donor community		Billions of dollars	Agricultural projects in communal areas

**Suspended in February 2002 when politicians and influential businesspeople hijacked the tractors*

Externally, several countries made donations in the form of machinery and equipment to help ease the work of small farmers. These included tractors, combine harvesters, fertilizers, seed drills and agricultural chemicals. Sadly, Japan's support in 2002 was suspended due to corrupt politicians and influential businesspeople, who grabbed the tractors at the expense of deserving farmers. Well-deserving farmers continue to be side-lined left, right and center, despite millions of public funds being spend under the guise of helping poor farmers. In reality a few people enriched themselves through these programs and not the poor farmers.

No loans and or credits

As farmers could not access ***loans and credits*** from the banks, which were forced either to reduce or to stop issuing loans because of the crisis, this made farming more difficult, as farmers still need cash for the purchase of seeds and fertilizers before the beginning of the farming season, as well as for packaging materials, storage, transport and some workers' wages. Together the lack of loans and credit, the breakdown in extension services and the ***failure to maintain public infrastructure*** had devastating consequences on farmers' ability to deal effectively with crises. Due to fiscal constraints the government gradually stopped the maintenance of public infrastructure such as roads, bridges, schools, clinics and hospitals. The withdrawal of public investment, especially from road maintenance, resulted in high transport costs, and farmers were hardest hit, as the delivery of farm produce to markets was made almost impossible or ate into all the profits the farmer could possibly make.

However, in three of the case studies, 'small-scale farms, resettlement area and impoverished landscape', the challenges of reduced public services have been ***partly compensated for by NGOs and private companies*** (Table 15) through contract farming (for tobacco farmers) by private companies.

Also, donors and NGOs helped with extension services in irrigation projects and among farmer groups, particularly in two of the case studies located in 'intact and impoverished landscape'. Often these external extension agents were mobile and promoted low-cost technologies as a response to ever-changing climatic conditions.

Table 15. NGOs, private companies and community-based organizations that supported the farmers in the case studies.

Case study	NGO	Program
Small-scale farms	EU STABEX/NADF	Heifer loan program in 2010
	Land 'O' Lakes	Capacity building in 2013
	Keffalos	Capacity building on fodder production from 2011 to date
	Aldington	Cattle-bank fund and capacity building since 2015
	Mashonaland Tobacco Co	Tobacco contract farming
	GoZ	Command agriculture*
Resettlement area	Mashonaland Tobacco Co	Tobacco contract farming
	GoZ	Command agriculture *
The community in the intact landscape	European Union (EU) and Government of Zimbabwe (GoZ)	Mhakwe irrigation (53)
	Misereor & Caritas Mutare	Dembweni irrigation (28)
	Misereor & Caritas Mutare	Conservation farming and small livestock production (240)
	Caritas Denmark & Caritas Mutare	Sungano irrigation (61)
	World Vision	Chitobo irrigation (70)
	Caritas Denmark & Caritas Mutare	Chirongwe irrigation (60)
	Kamutserendende	Mutserendende irrigation (25)
	Kellogs Foundation, Christian Care, TSURO, Windows of Hope and Kamutserendende	15 nutrition gardens with 10-15 members
	South Eastern Dry Areas Project (SEDAP)	4-year cattle-breeding program*
	Government of Zimbabwe (GoZ)	Command Agriculture*
The community in the impoverished landscape	Misereor & Caritas Chinhoyi	Conservation farming and small livestock production (400)
	Misereor & Caritas Chinhoyi	Irrigation garden (54)
	Mashonaland Tobacco Co.	Contract farming (197)
	GoZ	Command Agriculture*

**and ** numbers and/or name of donor not provided*

To cover the breakdown of extension services, donors (Misereor, Caritas Denmark, and World Vision), local NGOs (Caritas Mutare and Chinhoyi) and private companies (Mashonaland Tobacco Company) launched program packages that included external extension agents who mostly served irrigation groups and farmers' groups, mostly in 'intact and impoverished landscapes' case studies. The Mashonaland Tobacco Company provided support with inputs, extension services and a guaranteed market for the tobacco grown under contract farming arrangements in three of the case studies, 'small-scale farms, resettlement area, and impoverished landscape'. To compensate for the lack of loans and credit, (EU STABEX/NADF) provided a heifer loan program for farmers located in the case study 'small-scale farms' in 2010, and in 2015 (Aldington) also provided funds for a cattle bank from which farmers borrowed money to increase their herd size. Similarly, the South Eastern Dry Areas Project (SEDAP) supported farmers in the 'intact landscape' with a four-year cattle-breeding program.Other donors and community-based organizations also played a critical role, as in the case of Land 'O'Lake and Kefalos in the small-scale farms who provided capacity-building and fodder production among milk farmers. Also, a local CBO (Kamutserendende) financed the establishment of an irrigationproject that benefited 25 households, while the establishment of fifteen nutrition gardens was backedby several donors and CBOs in the 'intact landscape' case study.

For the few banks and other financiers that offered loans during the Zimbabwean crisis, the interest rate in thousand % went from 38, 021% in 2000 to 1,175, 026% in 2008. In 2016 the lending rates quoted by the banks ranged between 20-30% per annum and were quite restrictive for majority of poor farmers, who regarded them as high risk: repayment depended on yields, but with unpredictable rainfall patterns, good harvests were highly uncertain. None of the farmers in the four case studies reported having applied for bank loans as the crisis intensified, particularly in 2006 to 2016.

4.1.2 Unpredictable rainfall and droughts

Over the years, there have been changes in rainfall patterns that have become increasingly unpredictable. Often ***less rainfall*** is received, despite seasonal forecasts pointing to the prospect of normal rainfall, and the rainfall that is received across the entire country is less and unevenly distributed. The ***unpredictability of rainfall*** is often manifested through the late onset and early session of the rains, which is often interrupted by ***higher frequencies of extreme weather events,*** such as long dry spells, heavy winds and hailstorms. In situations like these the cropping season starts late, and more often in the peak of the rainfall season, which is usually in February, farmers reported having received at most less than 75% of what they would normally receive in a good season. Farmers also reported that the rainy season had become shorter (five months from the previous seven months), requiring them to make the necessary adjustments to adapt to the changes in rainfall. Particularly in 2016, the case studies in 'impoverished landscape, resettlement area and intact landscape' left the majority of dams with well below water capacity, while some dried up, as in the 'impoverished landscape', as did rivers, streams and boreholes due to the poor rainfall. This in turn caused water shortages that threatened both human and animal life, as safe water, irrigation water and sources of drinking water for animals are increasingly drying up.

Grazing is also become limited due to the reduction in rainfall. As the majority of the farmers depend largely on rain-fed agriculture, unpredictable rainfall patterns pose serious challenges to the growth of crops, as water is need for planting and throughout the growing season. With less rain, some parts remain relatively dry after receiving very low rains, as in the case studies located in 'impoverished and intact landscapes', while others receive effective rains, as in the 'small-scale farms and resettlement area' case studies, and often plant earlier than farmers in the other two case studies, who, when they plant crops, risk them wilting. Less rainfall creates water shortages and thus threatens human and animal life, as safe water, drinking water for animals and irrigation water diminish and dry up. Consequently, the shortages of water pose a threat to household incomes, as rural households normally depend on livestock sales to raise income for inputs, food and other household requirements. Also affected are nutrition security, the draught power of animals and transport.

During the past decade, farmers have suffered ***more droughts*** than ever before. According to farmers, there has been an increase in the number and intensity of droughts. Although most droughts are described as having been mild, for farmers in drier areas any type of drought poses serious repercussions on their livelihoods. Extreme droughts were experienced during the farming season of 2002/2003 and 2015/2016. The latter was an extreme drought, despite the national outlook seasonal forecast pointing to the prospect for a normal to below normal rainy season. The drought season of 2016 was worsened by the El Niño weather phenomenon, which affected the whole of southern Africa by creating a drier region that seriously threatened the livelihoods of rural farmers. In 2016, during the peak of the rainy season in February, almost the entire country had only 75% of rainfall of what would normally receive. The dry period was extended and the cropping season delayed, being interrupted by mid-season dry spells that caused the crops to wilt. Many crops were written off, prompting the then President R.G. Mugabe to declare a state of disaster and appeal for donations to save people from hunger. This drought reduced the amount of water needed to meet basic household consumption needs, support for their livelihoods and agriculture. The entire country was affected, with those most affected being the traditionally low rainfall regions III, IV, and V, where the four case studies are located, but even the traditionally food-secure regions I, IIa, and IIb were also severely affected by this drought. Recurrent droughts pose a serious challenge to farmers located in drier areas by threatening the livelihoods of the affected households.

4.1.3 Markets distortions

Input prices went up

One manifestation of market distortion was that input prices went up beyond the reach of the majority of farmers. With high input costs, farmers found it extremely unprofitable or even impossible to

market their own produce. Agricultural input manufacturers and agro-business dealers were forced to increase input prices because of the prevailing economic situation. In particular, the price for certified maize seed, fertilizers and pesticides went up beyond the reach of many poor farmers. This situation was compounded by the removal of subsidies, which in the 1980s the government had previously used to cushion rural farmers by making input prices relatively affordable for all rural farmers. This removal of subsidies was also affected by the implementation of the Structural Adjustment Programme in 1991-1995. Since then, the prices of inputs have gone up in accordance with the country's economic performance. In the early 2000s, although input prices were quite high, farmers could still afford them. During the hyperinflation period from 2005 to January 2009, their prices were highly inflated, but again farmers could still manage to buy them for a comparatively reasonable price. From February 2009, under the Government of National Unity (GNU), the country adopted multiple currencies, and prices stabilized until 2013, when the ruling party won the election and prices gradually rose to the level at which the majority of poor farmers could not afford them without external support. Of particular note is the shortage of ammonium nitrate (AN) fertilizer, a key top-dressing agent for crops. With shortages on the official market, the price of AN went up on the parallel market, beyond the reach of most small-scale farmers. This is true of most agro-chemicals and inputs. Furthermore, transportation of inputs from the market to the farms often pushed the prices of commodities beyond the reach of the small farmer. In addition, hyperinflation of the local currency and fluctuating market prices for maize at the GMB pose a major threat to the viability of small-scale farmers. In the case study, farmers reported having reduced the area under maize cultivation as a response to unviable market prices. As a result, 15% of farmers started growing tobacco in three of the case studies, in 'small-scale farms, resettlement area, and impoverished landscape", often backed by private company support.

Output prices fall

The Zimbabwean crisis has also manifested itself through the ***fall in output prices*****,** for example, the price of maize. Maize is both a staple and a cash crop, and for this reason it is grown by almost all farmers in the case studies. Before the crisis, the majority of small-scale farmers were producing maize for the market, but the failure of the state-driven Grain Marketing Board to provide maize farmers with better pricing and payment patterns resulted in many farmers abandoning maize production. Thishad a ripple effect on industries that largely depend on this product, forcing the majority of them outof business. It also created production shortages, which turned the country into basket case, as for thepart of period from 2000 to 2018 the government had to import maize to feed its people. Another challenge with the output market was the flooding of the market for one product at certain times of the year, resulting in low incomes, as farmers were often forced to reduce their prices, especially of perishables like green vegetables and tomatoes. The lack of proper market information results in oversupply, price collapses and the erosion of incomes.

4.1.4 Social instability

Violence, distrust and loss of lives

The Zimbabwean crisis also manifested itself through ***violence*** perpetrated on others mostly atelection time. In particular, the 2008 election was reported as the most violent in the history of thesefarmers. It took various forms, with some farmers reporting having been beaten or mutilated, with ***lossof life***, as well as loss of food stocks and livestock. This left communities polarized along party lines, with growing ***distrust*** among community members who were hurt or traumatized during these violent attacks. According to the farmers, the violence was committed by known people from the same community, and the perpetrators have not been prosecuted, despite reports having been made to thepolice, who since 2008 have not instituted any investigations into this misconduct. Some of the perpetrators are relatives and/or neighbors of the victims. As the cases of violence were never investigated, nor were the culprits brought before the law courts, this has affected social organization,particularly in the three case-study sites located in 'resettlement area, intact and impoverished landscapes.' As such, wounded communities require healing for them to effectively respond to crises.In contrast, the farmers in the 'small-scale farms' are had no similar reports of violence, distrust or lives lost.

Weakened social organization

This situation led to the weakening of social organization within communities, particularly in the three case studies that experienced lots of violence. The situation with social organization varied from one case study to another, mostly based on the degree of violence committed in the area and how close-knit these communities were before the violence. The close-knit community used whistles to alert others whenever there were intruders or a household was under attack, but this was only reported in the 'intact landscape'. Traditional leaders (the chief and village heads) in this case-study area also played a critical role in protecting their people by declaring their area free from any form of violence, in so doing strengthening social cohesion and formation among villagers. Thus, some villages that experienced less or no violence at all were found to be working collectively together, whereas in those that were heavily affected by the violence their social organization was weak, for example, in the 'resettlement area'. In this latter area farmers mostly worked individually, which may be explained by the fact that farmers were settled on self-contained farms, lived far apart from one and were all new and unknown to each other when they moved on to their farms. In particular, the 2008 election was reported to be the most violent, several opposition supporters being mutilated, others killed, and harvests and animals being looted. This resulted in the weakening of social formations, family ties and social cohesion, making it difficult to restore day-to-day relations and mutual support between victims and perpetrators. Therefore, for previously close-knit communities especially for the case studies located in 'intact and impoverished landscapes', the breakdown of social networks constrained them from effectively coping with crises and disasters. In particular, political violence resulted in more individualistic tendencies, thereby reducing collective structures among affected communities. However, the fact that torture bases existed during the 2008 election hampered any collective efforts, whether within or among victims and perpetrators. Despite all the challenges, people began to look out for each other. The study found out that about a quarter of households were part of an organized group, with an irrigation project, dairy association, farmer group and/or Internal Savings and Lending Clubs. These organized groups were more pronounced in the case study located in 'intact landscape', followed by 'small-scale farms', and least in 'impoverished landscape'. One of the four case studies had no farmers organized in groups: in the case study located in the 'resettlement area' farmers worked individually.

Family disruption

The above described manifestations of crises disrupted some families, which were forced to go into hiding at election time, and especially for fear of their lives, while others continually lived in fear, as remaining family members were targeted and tortured. In the case study located in 'impoverished landscape', a few were forced to abandon their farms. Although farmers were careful of what they said for fear of being victimized, they reported that often in the periods before and after an election, some members, especially those aligned with the opposition party, prompted others to ***migrate*** to safer areas. The other challenge farmers pointed out was the difficulty in trying to rebuild social ties and affection, including new economic, social and environmental recovery pathways, after political violence and natural disasters within polarized communities. It is tragic that what is supposed to be exercising ones' democratic right to vote and speak their voice becomes a time of violence, coercion and bounded space.

4.1.5 Decline of production

Loss of produce, plants, harvests and animals

The situation of crisis resulted in considerable losses of produce, plants, animals and harvests, particularly in very dry situations like the 2015/2016 drought, when some crops, especially maize, were written off. Also, the aftermath of the politically motivated violence of the 2008 general election resulted in some farmers losing their livestock and harvests to looting by perpetrators. The after-effects of disasters often left poor farmers devastated, as they lost not only their produce or harvests, but also their incomes, since most of them depended on the sale of farm produce and livestock to raise the cash needed for inputs, food and other household requirements. While almost all farmers suffered

losses, the poorer households were the hardest hit, particularly poor farmers from the 'impoverished landscape'. This confirms the almost universal truth that says in times of crises it is the poorest of the poor who always come last and suffer the most.

Another manifestation of crisis was the ***reduction of productivity,*** as farmers in the case studies could raise capital or borrow money to purchase farming equipment, fertilizers and other inputs to increase their productivity. This was further compounded by the limited water needed for planting and throughout the growing season, yet farmers suffered recurrent droughts and higher frequencies of adverse events, which militated against improving productivity. Recurring droughts account for the vast majority of the reduction in agricultural production, which in turn created food insecurity, income loss and income insecurity. The majority of farmers in the four case studies reported a decrease in production due to periodic droughts, except for a few farmers with irrigation facilities who used them to modify and extend the growing season.

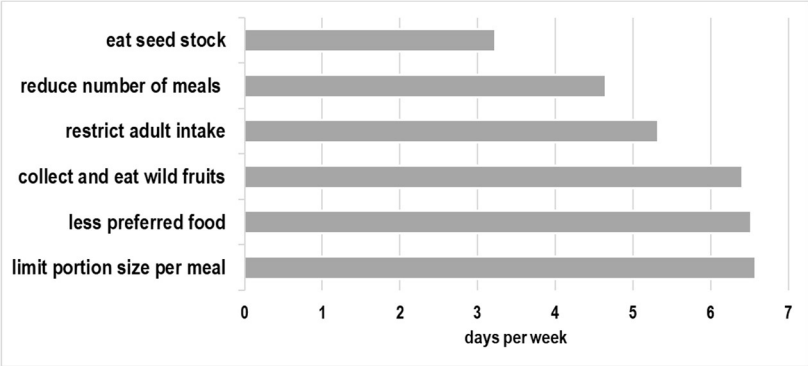
4.2 Farmers' responses to the Zimbabwean crisis

This section describes the different farmers' strategies in responding to the situation of crisis, which took two forms: immediate reactions and strategic responses.

4.2.1 Immediate reactions

The immediate reactions of farmers when their survival is threatened with possible food shortages, particularly among poor households, include food-compromising and finance-coping strategies. The most frequent food-compromising strategies mentioned during group interviews with farmers included limiting the size of portions per meal, eating less preferred foods, collecting and eating wild fruits, restricting adult intake, and reducing the number of meals a household eats per day (Figure 13).

Figure 13. Frequency of food-compromising coping strategies by poor households across all case studies



The frequency of coping strategies varied from one case study to another, and from one household to another. Overall, the poor households in all case studies applied three common strategies to cope with limited food availability in times of severe crisis: they limit the size of food portions per meal, switched to less preferred food and started to collect and eat wild fruits more intensively. Families did this almost throughout the week. Less frequently but also often, adults had to reduce their own food intaketo feed their children, reduce the number of meals or started consuming seed.

4.2.1.1 Food-compromising reactions

The consumption of less preferred food, wild fruits and seed stocks, and limiting portion sizes, adult intakes and daily meals per day, were more common among the households located in the 'impoverished landscape' than was the case in the other three case studies. The study also revealed that reliance on wild fruits like baobab (*Mawuyu*), Uakapa kirkiana Mazhanje (*Mazhanje*) and Muhacha (*Hacha*) were again more common in impoverished areas and to a lesser extent in the case study located in 'intact landscapes' compared to the other two case studies. Depending on the food situation of a household and the severity of coping strategies, the strategy of skipping meals for a whole day was considered very severe for farmers, mostly those located in the 'impoverished landscape' and also those in remote areas of the 'intact landscape' case study. Across these two communal area case

studies, the strategy of sending children to eat at neighbors or relatives was seen as similarly severe, but most severe for the community in the "impoverished landscape". Households located in individualized contexts in the 'small-scale farms and resettlement area' did not opt for this strategy due to the distances between farms and the absence of kin ties like those found in communal areas. According to farmers, the most severe coping strategies were those in which struggling households conceal their lack of food due to the stigma associated with this. Also placed among the most severe coping strategies was the practice of household members, especially adult members, but men rather than women, skip meals for a whole day so that their children can have something to eat. Such strategies are considered to be short-term, and when their very existence is challenged, farmers often decided to intensify their exploitation strategies. While borrowing food from relatives and neighbors was frequently mentioned in difficult times of food shortages, this strategy was also considered short-term, unsustainable and most severe, since they have to reciprocate, failure to do which would limit their ability to borrow again.

Of the six most common food-compromising coping strategies, eating less preferred food was identified as the least severe. However, as already mentioned, perceptions of severity differed across the case studies: for example, borrowing food from neighbors was perceived as least severe by the community in the 'impoverished and intact landscape' case studies, as it is considered a normal and acceptable way of reacting in times of crisis or when a household lacks food. Among households in 'small-scale farms and resettlement area' case studies, this was considered the most severe coping strategy.

4.2.1.2 Finance-coping reactions

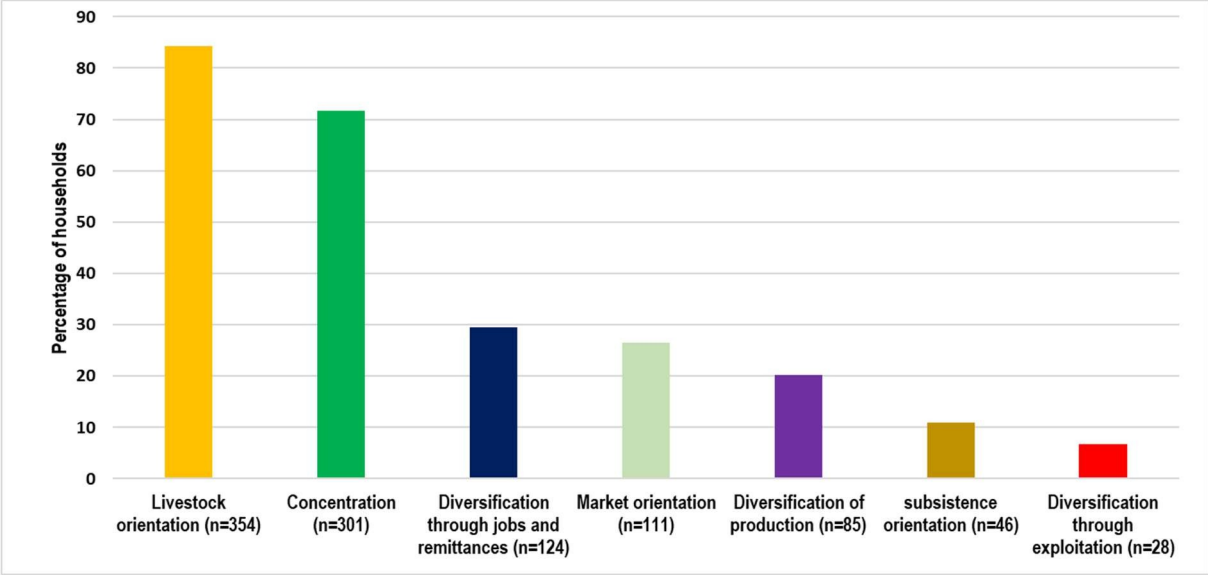
Lacking any other options to raise an income during a crisis, farmers reported that they occasionally borrow money from relatives and neighbors with a promise to repay within an agreed timeframe. Farmers, however, regarded this strategy as most severe and shameful, particularly as it makes their food shortage public, let alone the struggle to raise the money to reimburse the moneylender. The few options available to them in raising an income included small-scale trading, which was mostly practiced by households located close to urban centers, while those far away often resorted to selling animals, especially small livestock, as a food-coping strategy. Our findings also showed that women in particular engage in various income-generating activities to raise money to buy food. Others engage in barter trade for foodstuffs: for example, in the 'intact landscape', poor households would exchange their labor for a bucket of maize or would offer animal manure in exchange for food.

4.2.2 Strategic responses

The different strategic responses of the farmers are shown in Figure 14. They can be divided into two categories: on-farm and non-farm strategies. On-farm strategies are related to agricultural activities that are performed on a daily basis, seasonal, or annual basis whereas non-farm strategies are not related to agriculture e.g., remunerative employment. Each response strategy within these categories will be explained in detail, and their general relevance will also be assessed.

The most frequently adopted strategies were to focus on livestock (84%) and agricultural concentration (71%). The intermediate responses to the Zimbabwean crisis included those farmers who diversified through jobs and remittances (29%), oriented themselves to markets (26%) and/or diversified their production (20%). The latter, however, is far more prominent, as in both responses (concentration and market orientation) together farmers did not grow one crop but rather a wide range of crops, fruits and vegetables. There were low frequencies of farmers who re-oriented themselves towards subsistence farming (11%) or turned to exploitative strategies (7%). The changes to livelihood strategies clearly indicate that, in all four case-study sites, to secure their livelihoods the farmers responded to crisis situations described in the previous section. The analysis revealed a wide range of strategies. Grossly simplifying, it is possible to group these responses into seven categories of varying relevance (Figure 14). Often, the farmers showed a mixture of these responses.

Figure 14. Proportion of farmer's responses to the Zimbabwean crisis over all case studies



4.2.2.1 Livestock orientation

Our data showed a significant increase in the number of households (84%) engaged in livestock production (Figure 14). In three of the four case studies, up to two thirds of the farmers increased herd size or small livestock. Small-scale farmers in the flatland case study mainly ventured into milk production, which considerably increased the village production of milk from 1,200 liters a day in 1998 up to 6,000 liters in 2016 (own data). The increase in dairy production in the small farms study site was again induced by external support for the establishment of a cattle bank in the form of a revolving fund that provided resources for the purchase of dairy cattle based on one's current herd size and ability to repay. In partnership with Kefalos, a well-established dairy producer in the adjacent area, a joint management deal was agreed. Kefalos assisted dairy farmers to become better organized, take care of the required vaccinations and grow their herd size. In addition, they received regular training in howto handle cattle and milk, and to improve pastures and water supplies. Also, the community in the intact landscape received significant external support from Misereor through Caritas Mutare that provided training in animal husbandry and distributed small livestock to groups of households. The project is based on the idea of local multiplication and thus predicted that the recipients of support would pass kids or chicks to other households. Due to limited grazing land, the majority of farmers invested in small livestock such as goats, chickens, turkeys etc. Through Caritas Chinhoyi, Misereor alsosupported the community in restoring degraded land with livestock, but farmers reported having losttheir livestock due to disease and the scarcity of stock feeds. Very few households still had small livestock, which survived due to the extra work households invested in securing stock feed and vaccinations.

In the resettlement site, farmers increased their cattle by buying it after the tobacco sales. In fact, most farmers maintained a sizeable herd of cattle due to the availability of grazing areas, but in two of the six villages, farmers had to reduce the size of their herds when grazing land became scarce after the governmental land agency started allocating land to new settlers in 2015. The government expected these newly settled farmers to become commercial producers, but without any form of support. The farmers at this site only received occasional governmental support every fifth year when there were elections, support that was anyway normally restricted to party supporters. This lack of technical and financial assistance to the farmers on 'contested' land seriously hampered the performance of the poor-resource farmers to effectively grow their herd sizes and to improve their capacity to generate sufficient manure to fertilize their crops.

Despite the many challenges associated with successful livestock rearing, such as frequent disease and limited grazing areas and stock feeds, the farmers in the case-study sites who invested in livestock

strongly benefited from the draught power, transport, manure, milk, meat and cash income they derived from it. Actually, for many households, meat and goat's milk were crucial for nutrition, particularly of women and children. The increased availability and application of organic manure also increased the productivity of both crop production and stock feed for the animals. Also, an increase in productivity was often translated into an increase in income as surplus food was sold to raise cash, but more important was the relief of farmers from dependence on the government's subsidized inputs, such as fertilizers, as these are compensated by sufficient and consistent use of organic manure. The latter improves soil fertility naturally, resulting in more or less the same effect as with chemical fertilizers when it comes to increasing the productive potential of the fields in an environmentally friendly way.

4.2.2.2 Concentration

About 71% of farmers across the case studies continued to use their land by concentrating their production on the most suitable land in response to crises (Figure 14). This strategy enabled farmers to produce more than enough food for their families, as many of them even started to produce cash- and food-crops more intensively for the market. The point of this strategy was to cultivate smaller portions of their fields and concentrate scarce resources on small plots to improve food security. Most of the farmers who concentrated their production reported a significant increase in yields per hectare compared to before. As a consequence, regardless of the smaller areas under cultivation, theyregularly produced a surplus, which they sold to raise an income.

In accordance with scarce and costly inputs, farmers choose to reduce, concentrate and intensify their production on a much smaller area of the most fertile land while switching in parallel to the application of low-cost technologies, such as the use of open pollinated variety seeds, organic manure, crop rotation, retaining crop residues for stock feeds, compost making and mulching. In short, the concentration process involved the utilization of small areas of land using appropriate technologies for higher returns. Farmers also combined crop and livestock production to use scarce resources more efficient. Only in the resettlement site was this strategy ignored by farmers who had just started their farming activities with an exclusive focus on the production of commodities. However, concentration was pursued on reduced pieces of land, such as half the cultivatable area of six hectares, farmers have a formal right of use. In many cases, particularly if supported by technical assistance, farmers who did follow this strategy also started to adopt soil and water conservation techniques, such as reduced or zero tillage and permanent soil cover. Some farmers even started or intensified irrigation measures. This happened particularly in the case-study site representing communal lands in 'intact landscape', because here the farmers benefited from NGO-supported small-scale irrigation projects (Table 16), which allowed them to grow wheat and a variety of vegetables out of season.

Table 16. Small-scale irrigation schemes supported by NGOs for communities in intact landscape from 1098 households

Name of irrigation project	Established in (year)	Supported by	No. of households	Plot size in (m^2)
Mhakwe	2000	EU and Government of Zimbabwe	53	1000
Mutserendende	2010	Kamutserendende	25	200
Chirongwe	2002	Caritas Denmark and Caritas Mutare	60	700
Dembweni	2004	Misereor and Caritas Mutare	28	800
Sungano	2014	Caritas Denmark and Caritas Mutare	61	800
Chitobo	2017	World Vision	70	800
Nutrition gardens	2003-2006	Christian Care, Kellogg's Foundation, Kamutserendende, TSURO	150	10

Source: data gathered during fieldwork Nov 2017-Feb 2018

Intensified irrigation on small plot sizes ranging from as small as 200m^2 for some and to between 700m^2 to a 1000m^2 for others was mostly used in maize production during the rainy season, winter wheat and vegetables to a lesser extent, the latter being the preferred crops in nutrition gardens because ofthe small size of the plots. Although many of the farmers who opted for this strategy depended on rain-fed farming, their adoption of soil- and water-conservation techniques, such as minimizing soil

disturbance, encouraging permanent soil cover, infield water harvesting and use of manure, resulted in many realizing yields even when there is erratic rainfall. This strategy of reducing and concentrating inputs secured most of the food needed for a household's own consumption while in parallel allowing farmers to sell any surplus production if there were sufficiently attractive, mostly local markets within reach.

In particular, farmers who opted for this strategy basically did so in order to save their scarce resources. Instead of spreading these scarce resources on larger areas of land with low yields, they opted to concentrate them on the most suitable land for the highest returns. The majority thus achieved food and nutrition security, as many produced surpluses which were sold either on local markets or to the Grain Marketing Board, thus increasing income security. Farmers who opted for reductions and concentrations of inputs used costly inputs and scarce resources more efficiently to cultivate the most suitable areas of their land. Another positive effect was that this strategy allowed the re-growth or natural regeneration of shrubs and trees on fallow fields in those areas that were taken out from agricultural production. Beyond the provision of environmental services, these woodlots provided a new source of urgently needed fuelwood. In general terms, this strategy reduced the overall production of a property, which as a consequence led to a decline in the supply of agricultural raw materials in the study areas. This shortage seriously affected the dependent processing and refinement industries downstream. However, on many farms the decline in production area was compensated by an increase in the productivity of the remaining cropland that generally had the best fertility and water conditions on the property.

4.2.2.3 Diversification through jobs and remittances

29% of farmers decided to send one or two members to look for employment outside the farm (Figure 14). Some went to work on other farms, and others to urban centers and abroad, the latter consisting mostly of educated and skilled people able to find high-income jobs away from the farm. This strategy enabled farmers to raise incomes through jobs, as household members who had migrated would regularly send remittances back home in support of the remaining family members. As the opportunities to raise incomes through farming declined, the focus of this strategy was to raise the much-needed income through off-farm activities, particularly remunerable jobs.

Before the Zimbabwean crisis, farmers throughout the country benefited from effective technical assistance and subsidies for fertilizers for the cultivation of selected crops. These policies assisted many poor farmers in increasing productivity and earning incomes from farm produce, while also supporting specialization of the promoted crops. In times of crisis, due to reduced assistance and increased input costs, it became difficult for the farmers to sustain their livelihoods from the production of one crop alone. To reduce the risk of depending on a single crop, most farmers in the case-study areas became involved in two or more income-generating activities. Compared with the period before the Zimbabwean crisis, more farmers diversified their production or combined on-farm with off-farm activities. Farmers need money for a variety of other things that are not produced on the farm, such as basic foodstuffs like sugar, salt and cooking oil, but also clothing and most importantly money to pay the school fees for their children, as well as medication when the need arise, transport and agricultural inputs. For these reasons, some households decided who would leave the farm, but most often it was young men, particularly adult children, who left in search of remunerative employment. While 25% of husbands left *de facto* female-headed households behind with an absent husband, many husbands would visit the family occasionally during public holidays and annual leave, depending on where they live. Most importantly they would regularly send remittances back to their wives whom they left in charge of managing the farm. Depending on the level of education, the highly educated would most often respond to job opportunities with high returns, while the least educated often took low-return jobs, mostly on other farms. Remittances are used to make farm improvements, diversify production to include a variety of crops and keep livestock. Although not all migrated household members were able to send remittances home regularly, at least for those who could do so, their households reported also having managed to have diversified their production, increased their assets

and send their children to school, while those without remittances struggled to survive and often had to pull their children out of school for non-payment of fees.

In at least half the diversifying households, the receipt of remittances from family members living in urban areas or abroad helped recipient farmers develop their land and purchase the necessary inputs while buying food and other products for basic household supply in stores and local markets. This strategy therefore helped households to generate an income, which in turn enabled them to respond effectively to crises by ensuring not only income security but also food security.

However, the massive out-migration of the most productive age and gender groups left behind a society of elderly, women and children, who have to work more and deal with the hardships of rural life on their own. In many instances, it was also this lack of a family workforce that drove households to decide to drastically reduce the area they kept under cultivation. The latter practice had environmental benefits that helped slow or reverse land degradation through the natural re-growth of trees, shrubs and grass, which provided new ecosystem services.

4.2.2.4 Market orientation

In three of the four case studies, we found a moderate number of farmers (26%) who had decided to dedicate their best land and the still available (significantly declined) input to cultivate cash crops, most importantly tobacco and, to a lesser extent, winter wheat (Figure 14). In most cases, this strategy was induced by external support for tobacco farming and for establishing or improving irrigation schemes. For example, winter wheat production has thrived in irrigation projects established with the financial support of non-governmental donors, whereas tobacco farming was supported mostly by private companies interested in securing their supply of raw materials. This strategy focuses on generating the much-needed income to finance the farming business and meet other household requirements.

The majority of those farmers who concentrated their inputs on the production of commodities managed to overcome the level of subsistence by generating the much-needed cash. In addition, cash-crop farming indirectly boosted a fair number of downstream industries, such as milling, baking and food outlets in the case of wheat production. In the case of tobacco, farmers often benefited from a contract in which they repaid the loan of inputs and accompanying services with an agreed number of bales, the rest being their profit. The majority of farmers have continued producing under contract arrangements because they can then intensify production to maximize profits by producing high-grade tobacco leaf and most importantly by realizing sufficient surplus bales as their profit. Transaction costs are removed completely for farmers located near markets in the 'small-scale farms and resettlement area' case studies, as transport is part of the whole contract package. However, the situation was different for tobacco farmers in the 'impoverished landscape' case study, who are located far from the market and therefore had to organize their own transport, which farmers said was very expensive. To save costs, farmers in this area sourced transporters in groups, which drastically reduced the transaction costs more than if each farmer would do this individually. Since tobacco production is labor-intensive, almost all farmers in the three case studies reported hiring seasonal workers to help with planting, weeding, harvesting and curing. If the crop was poor, farmers would suffer huge losses, as they still had to pay the workers, and even worse for farmers who had to pay for transport to auction floors. In general, farmers reported making profits from tobacco farming especially when there is adequate rainfall and optimal use of fertilizers. They described the harvests as more often good than bad except in a bad season with drought or hailstorms. While farmers with irrigation can prolong the growth period for tobacco when there is a drought, however, there is no measure against hailstorms, which are liable to leave a trail of destruction of crops and drastically reduce harvests.

Since the fall of the maize price, which the majority of farmers used to grow as both a staple and a cash crop, in order to maximize their profits from farming, these farmers switched to tobacco, which guaranteed them meaningful incomes. However, they still produced maize, mostly for their own consumption, while tobacco was the crop of choice as the only high-return and profitable crop. In the

case of farmers in the 'intact landscape' case study, with irrigation facilities, wheat production benefits are two-fold. Farmers can raise the much-needed income by selling to millers and bakeries, but they can also store wheat for long periods and use it to replace maize in the event there is not enough food for the family.

Tobacco farmers in particular reported generating substantial profits from tobacco farming. This has a multiplier effect in that they are able to finance the growing of food crops, buy assets and meet other household requirements much more than households that are not engaged with the market. A negative consequence of increased tobacco farming was the overuse and part destruction of nearby forests due to the increased use of firewood to cure the golden leaf. Efforts to reduce this practice, for example, by promoting the growing of gumtrees, were not successful.

4.2.2.5 Diversification of production

In all case studies, some farmers diversified their crop production portfolio to include more staple crops, such as maize, sorghum and millet, cash crops and different species of livestock. About 20% of households opted to diversify their production (Figure 14). In most cases, households that did so had external support, including remittances, which also played an important role. The more diversified a household the more food it had available, but also the more diverse produce it could sell on the market. Thus, diversifying production provided a more varied diet for the family, as well as being a wayto earn an income.

As well as including more staple crops (maize, sorghum, and millet), farmers who had diversified also reported keeping portions of their land where they grow legumes like beans, groundnuts and cowpeas, sometimes intercropped: those that complement each other well, like maize and legumes, were especially often grown together. Small grains were mostly grown separately. The intercropping of leguminous crops was particularly important for farmers cultivating small areas of land with limited soil fertility, as these crops provided the benefits of fixing nitrogen into the soil and providing the families with the high levels of protein they greatly needed in difficult situations as an alternative to meat. In addition to legumes, farmers who had diversified reported also growing root and tuber crops like potatoes, sweet potatoes, yams and carrots, that is, a variety of vegetables, and they also grow different fruit trees, oil seeds and cash crops, mainly tobacco, maize and wheat.

To these farmers, diversification enhances the food security of their households, but it also contributes to the environmental stability of the production system by improving soil fertility while getting high returns. Diversified farmers attributed the stimulus to diversify to adverse weather conditions that threatened their livelihoods. Diversifying their crops is therefore a risk management strategy allowing them to stabilize their income and available food stocks. This helps them minimize their exposure to total crop failures and/or price shocks. The study found that those who choose to grow cash crops (tobacco) also grow a variety of food crops as a way to spread the risk. As these farmers living in semi-arid areas and thus face a warmer production environment, the cultivation of a wide range of crops on the same plot, either intercropped or in separate plots, helps reduce the risk of complete crop failure, since different crops are affected differently by climate events (some are more drought-resistant, others are not). In the same vein, farmer who had diversified reported having switched to appropriate crop varieties and adopted integrated pest management, agroforestry systems and use of animal manure. They find such practices most suitable for crop diversification: for instance, they integrate early maturing crop varieties to match the shortened growth period due to changing weather and rainfall patterns. This is often combined with crop residue management as emergency feed for their livestock during the dry season, but it is also used as mulch to conserve the moisture on crops. Also, the adoption of agro-forest systems helps improve rain-use efficiency and soil conservation under rain-fed agriculture, which often has benefits for both the farmers and the environment. These practices also remove the dependence on irrigation systems and on fertilizer subsidies from the government.

The study also found that some farmers, especially those located in the 'intact landscape, small-scale farms, and resettlement area', used the diversification strategy to modify the length of the growing season using irrigation systems. Others used in-field water-harvesting and conservation techniques, particularly in the drier areas of the case studies located in 'intact and impoverished landscapes.' For farmers who diversified, diversification was not only meant to manage risks, but also to cope with economic shocks and market uncertainty. Thus, the diversification strategy offered these farmers alternative livelihood options in difficult situations. For farmers located near markets, diversification was seen as a way to raise incomes, while poor households without assets and located far from markets in the 'intact and impoverished' case studies were pushed rather to seek food and incomes from alternative but often risky activities such as exploitation. For the wealthier households, diversification was a way to increase productivity gains, which consequently pushed them from subsistence farming to more trade-based farming with net income and welfare gains. This strategy worked well for farmers located near markets (inputs and outputs), as they took advantage of the emerging opportunities of markets to increase productivity, for example, by responding to the high demand for vegetables. This in turn not only helped these farmers earn an income from diversifying their production system, it also enabled them to diversify into even more products for the market. They also attribute their success in diversifying to having reasonable access to information, which in turn enabled them to decide between alternative forms of crop management that left them better placed to cope effectively with crises by choosing an alternative that helped them minimize risks and costs. Farmers who had diversified reported mixing, say, maize (a high-yield, water-sensitive crop) withlegumes and small grains (less productive drought-tolerant varieties) as a risk-management strategy. For poor households who lacked access to information, particularly those households located in remote mountainous areas in the case studies in the 'intact and impoverished" and "resettlement" areas, diversification was seen as a survival strategy that helped them to cope with a decline in production due to climatic conditions, price shocks and limited options.

4.2.2.6 Subsistence orientation

About 11% of the households across the four case studies re-oriented themselves towards subsistence as a form of survival farming in response to the Zimbabwean crisis (Figure 14). This strategy focuses on the production of food and the raising of livestock required to feed their families. Sale or storage of the produce for later use were not intended or possible.

Before the crisis, most of the farmers in the case studies were able to produce surpluses which they sold in the local markets or to the *Grain Marketing Board.* This included especially the production of maize and legumes and, to a lesser extent, small grains. However, given the multiple changes to their farming conditions described in the section above, these farmers lost the ability to produce commercially. When households realized that their survival was threatened, they had to reduce or even avoid the costs to themselves by skipping costly inputs and reducing the need and expense of travelling to urban and business centers. They significantly reduced their cultivated area, irrespective of the farm size, and grew own food. In small very small plots of less than a hectare, for example 800m^2, they mainly pursued intercropping (crop-livestock systems) with food crops such as maize, millet and legumes. They often recycled seeds from the previous season's crop or got seed from neighbors or relatives. The majority completely skipped using external inputs while at the same time not having sufficient inexpensive animal manure to fertilize their crops. Only a few farmers used fertilizers and pesticides, and that only in sub-optimal amounts. Some households managed to maintain one or few cows to provide draught power for their farming activities. However, mostly they used traditional tools like hoes and depended heavily on family labor. These limitations, in sum, resulted in low yields and high rates of crop failure. These farmers were not able to work with irrigation given their financial situation, and without external support to establish irrigation systems, they gave up on working with irrigation.

With intercropping of more than one food crop, farmers were able produce a variety of food for their families. Due to the heavy dependence of these households on rain-fed agriculture, subsistence

farming worked when there was enough rain, but this was rarely the case. Especially in the frequent cases of droughts or irregular rainfall, production was insufficient. In parallel, the use of poor farming practices aggravated environmental degradation. Continuous cropping without measures to improve or at least maintain soil fertility resulted in further soil degradation, and the clearing of forests on farms and in nearby woodlots for shifting cultivation caused deforestation and reduced the biodiversity of soil ecosystems.

In most cases, the crops that were grown were not enough to feed the family, let alone to sell. In addition, these families were rarely able to buy household items that were not produced on the farm, such as sugar, salt and clothing. As a consequence, these households suffered from food insecurity, some of them even facing starvation, particularly in bad seasons, and having stunted and malnourished children. The majority did not have the means to buy food on the food market and thus required humanitarian support, particularly during lean periods. More positively, most malnourished children were reported to be on school feeding programs backed by external donors in collaboration with local NGOs. This support is provided to malnourished children, who are given at least one meal a day during the lean period.

Overall, subsistence families were trapped in structural poverty, since they lacked the means to increase yields and earn an income, being stuck on relying on low-return activities. However, subsistence farming still gave families the opportunity to continue to use their land and at least to a certain extent be self-sufficient in their food needs while continuously living on their farm, which was cheaper than living in urban areas.

4.2.2.7 Diversification through exploitation

Acting out of desperation, some households (7%) turned to the unsustainable exploitation of natural resources for survival. This strategy focuses on short-term immediate needs to satisfy survival needs, like having food for the family.

In particular, poorer farmers in the communal land sites, often those who had dropped out of school, intensified the exploration of resources on communal land. They explored mineral deposits along riverbanks, cultivated food crops on streambanks, collected wood, and exploited and processed clay deposits for brick-making. Farmers opted for such exploratory activities as a last resort when struggling to put food on the table. Often, the farmers chose this illegal option when affected a reduction in remittances as an effect of the Zimbabwean crisis, which also increased urban unemployment rates.

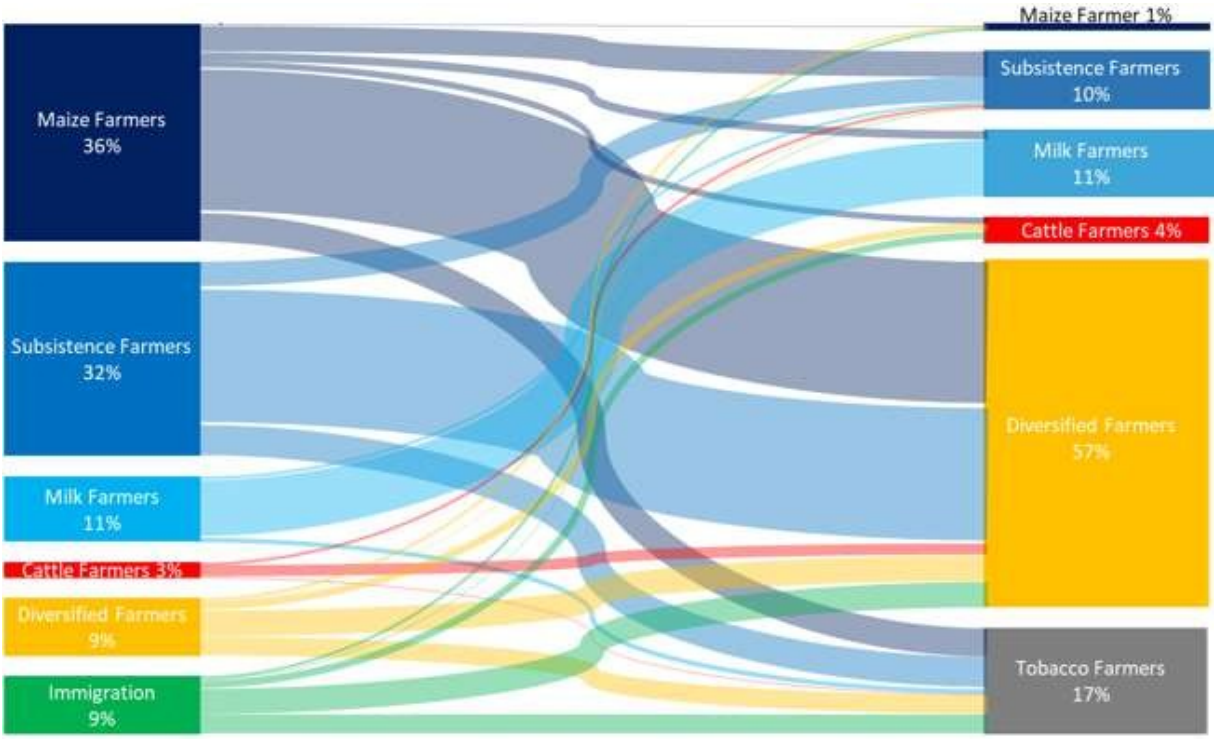
Our data suggest that the exploratory strategy does not generate enough income for the households involved to achieve food security. Accordingly, once engaged in exploratory activities, families' circumstance became worse and worse. In addition, due to the illegality of their activities, they suffered from continuously having to bribe law enforcement agents. The exploratory activities that were observed also tended to exceed the carrying capacity of the affected ecosystems, particularly in the case of long-term collective overuse. For example, mineral panning and streambank cultivation frequently resulted in the siltation and choking of rivers and dams. The release of dangerous chemicals polluted and disturbed the ecosystem, while excessive wood collection and brick-making threatened plant and animal species.

4.2.3 Changes of livelihood strategies

In all four case-study regions, the composition of land-use changed massively during the period of study from 2000 to 2016 (Figure 15). In accordance with the results described in section 4.2.2, there are observable changes in livelihood strategies in times of crisis that reveal new trajectories of farmer types. The majority of maize farmers (36%) who produced maize for the market in 2000 not only concentrated but introduced other strategies in times of crisis, such as diversified production, tobacco farming, subsistence farming, and dairy and cattle farming, with a mere 1% remaining as maize producers. Now, therefore most farmers have diversified, and a significant number have replaced

maize production with cash-crop production. What were previously subsistence farmers were mostly diversified farmers in 2016, while others switched to tobacco farming, leaving only about 10% of a previous 32% of subsistence farmers as subsistence farmers. In the case of milk farmers, these continued, only an insignificant number replacing milk production with cash-crop production. The few cattle farmers (3%) in 2000 replaced cattle farming and diversified, while an insignificant number re-oriented themselves to subsistence farming. In 2000, those farmers who had already diversified (9%) mostly continued, while others replaced food production with cash-crop production. Very few of the farmers who had diversified as of 2000 turned to cattle and maize production during the crisis period. The last category of farmer type comprised immigrants from urban centers and communal areas who moved to the resettlement area as a result of the land redistribution program. The majority of these immigrants diversified their production, while others replaced food-crop production with cash-crop production. A few immigrants became cattle and maize farmers, while others resorted to the production of food for their families for survival purposes.

Figure 15. Changes of shares of livelihood strategies proportions from 2000 to 2016 (N=420)



4.3 Influencing factors

This section presents the findings regarding the influence of the features attributed to the three categories of farm, person and institution on the scope of responses in times of crises taken by the households in the four case-study areas. For each feature analyzed within these categories, the general situation of the sampled households, the observed influences on their responses and the statistical relevance of the observations are presented.

4.3.1 Farm-level features

4.3.1.1 Farm assets

General situation

Farm assets needed for agricultural production listed by farmers included animal-drawn ploughs, tractors, combine harvesters, planters, harrows, chemical sprayers, cultivators, trucks, irrigation equipment and, most importantly of all, small livestock and cattle. Farmers considered cattle in particular as substantial because they fulfil multiple economic, social and cultural roles. In the context of the case studies, cattle were particularly critical for tilling the land and controlling weeds. In areas with inherent poor soils, manure was indispensable as an inexpensive fertilizer improving soil fertility. Cattle were also used for transport purposes, to provide food in the form of milk and meat, and as a

source of income. In addition, cattle were important as a savings asset due to the possibility to convert them into cash whenever needed. Besides selling live cattle, farmers reported the existence of local markets for cattle skins, hides and horns. Given the lack of access to bank credits, cattle were also used as collateral to secure informal loans. Against this backdrop, cattle were commonly perceived as a measure of prosperity, and farmers therefore tended to accumulate assets in the form of cattle. From this social perspective, cattle were also used for bride wealth and for communal ceremonial feasts. The more cattle a household owned, the higher its social status and the more they had of other farm assets.

In general, beyond land to grow crops and rear livestock, ownership of other farm assets was low among the poorer analyzed households. About (15%) of households had nothing other than the plot on which they lived and which they cultivated. A little more than a third (38%) had at least some assets, and only 46% were categorized as well-equipped. ***Well-equipped*** farmers were found mostly in two case studies ('small-scale farms and 'resettlement'). In the 'small-scale farm' case study, farmers had a long history of rearing cattle, especially for the production of milk, so that they had been working with cattle intensively over longer periods. The farmers in the 'resettlement' case study all started witha few cattle, but were able to gradually grow their herd size due to the availability of capital that they aggregated in their former lives as businesspeople or civil servants, or, at later stages, that had accumulated from income generated by farming. Also, the fewer well-equipped farmers in the other two case studies were mostly retired civil servants, war veterans, local leaders and successful farmers. Well-equipped farmers in all case-study areas regularly invested in growing their asset base from the money raised from the sale of tobacco, maize, milk and remittances. For example, well-equipped farmers reported that from 2010 to 2016 alone, they purchased additional cattle (20% of households), ploughs (33%), agricultural scotch carts (26%), water pumps (28%), solar installations (56%) and trucks and cars (22%).

Households without assets reported that they were constrained in increasing productivity because they depended on irregular and often tardy support from relatives or neighbors when asked to come and till their land with the remaining manure after having treated their own land. Households without farm assets often benefited from communal collaboration (*nhimbe* or *mushandirapamwe*), in which participating members occasionally provided the farm assets required for a given task. For example, community members with hoes lent them to the farmers so that they were able to do the weeding. The majority of farmers without farm assets were found in the two communal case studies located in intact and impoverished landscapes. Here, the poor households reported a vicious circle of a lack of agricultural assets and dwindling production capacity. In situations of crisis, it was common practice for farmers to sell first their livestock and subsequently also their other farm assets. This was often done in the hope that, when the situation improved, they would recover and replace their lost assets. However, crisis situations have continued for a very long time, leaving poor households struggling to survive and produce for their families. Once they had lost the little, they had, they found it extremely difficult to re-accumulate the means needed for the acquisition of new farm assets.

The farmers in the ***few assets category*** also had insufficient assets to undertake farm work effectively. For example, they might only own one plough, one cow and possibly a little small livestock insufficient to produce the much-needed manure. Such households were also largely hindered in properly managing their land. However, farmers with few assets often managed to team up with others in this category to obtain the required assets. For example, two families with a cow each and one with a plough agree to doing all the tilling together. Provided such cooperation was well planned and organized, farmers with few assets were also able to plant at the onset of the rains just like the well-equipped households. However, farmers in this category always depended on the willingness and availability of others to cooperate. The situation of households with regard to farm assets was strongly correlated with some of the other farm, personal and institutional features that were analyzed (Table 17).

Table 17. Spearman correlation coefficients between farm assets and the other analyzed features with their p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Farm assets	1.00	0.36	**0.04***	-0.04	**0.02***	0.77	-0.60	-0.01	0.58	**0.02***	**0.05***	**0.005****

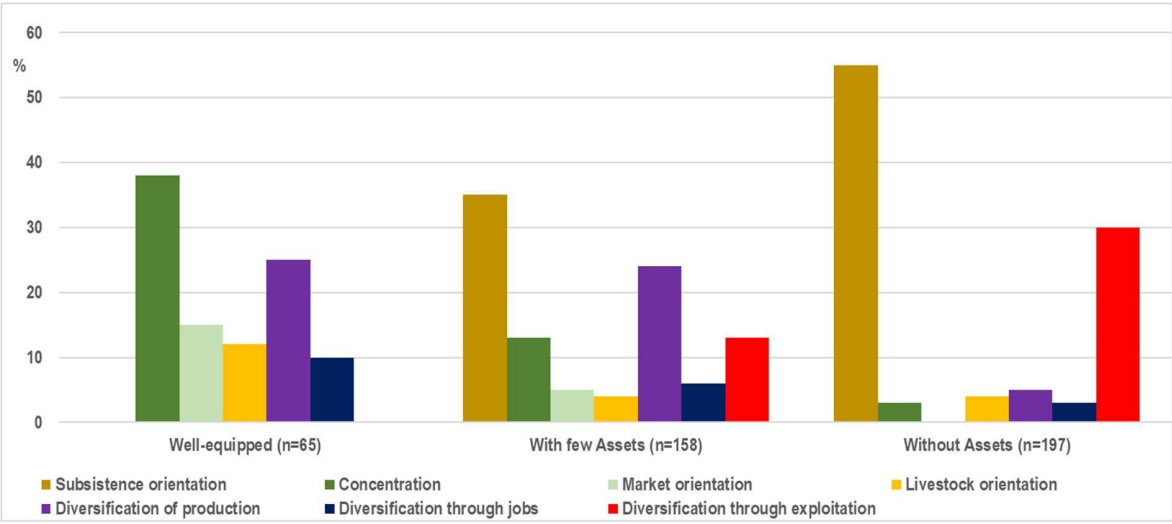
*Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)*

Most significantly, ownership of farm assets was positively correlated with the participation of the household in associations or other organized groups. For example, members of the dairy association had access to cattle-bank revolving funds that helped them grow their herd size, while farmer groups and Internal Lending and Savings Club members benefited from the support to small livestock production provided by NGOs. As such, the majority of farmers' groups and Internal Lending and Savings Clubs members had some small livestock. Beside the support from NGOs, in order to ensure that all members have small livestock, group members adopted the practice of giving a young goat, chickens or turkeys to the next member. Where this was well managed, improvements were made in livestock population and quality, other farm implements and machinery. Another strong correlation existed between farm assets and gender. Thus, having farm assets was more likely in male-headed households, even when the husband was absent, compared to female-headed households. This being a patriarchal society, rural men often prioritize the accumulation of assets to demonstrate their wealth. Women, conversely, previously owned no assets at all except for small livestock. Cattle and other farm assets traditionally belonged to men even when women contributed towards the acquisition of the assets. This tradition is still alive, and when women lose their husbands, all the assetsare taken by the late husband's relatives. However, through the intervention of various women's organizations and the Ministry of Women Affairs, Gender and Community Development, women are slowly acquiring farm assets in their name. Lastly, the probability of having farm assets increases the nearer the distance to markets. For example, higher levels of asset ownership were reported among farmers in two case studies in the 'small-scale farms and resettlement area' that are located close to major markets than the other two case studies in the communal areas located in 'intact and impoverished landscapes' that are further away from markets. The probability of owning farm assets also increased with access to financial support and extension services. This was true for households incase studies located in 'small-scale farms' with a revolving fund and communal areas located in 'intactlandscape', which had NGO support dedicated to the promotion of livestock production.

Responses

Households belonging to the different farm asset categories showed strongly different response patterns (Figure 16).

Figure 16. Proportion of farmers' responses to crises by farm asset categories



The households that were well-equipped with agricultural assets showed a wide range of responses to crises. Most frequently, such households concentrated or diversified their production, while other strategies were less frequent. None of the households in this category started exploiting resources or switched to subsistence farming. In contrast, (re)orientation towards subsistence and diversification through exploitation were by far the most frequent responses of those farmers with no farm assets. For them, other responses played nearly no role. Accordingly, households in the intermediate asset category showed a mixture of these two patterns. They showed all types of responses, however less accentuated.

During crises, **well-equipped** households with farm assets managed not only to invest in production for their own consumption, many of them even started to produce cash- and food-crops for the market intensively. Particularly those farmers who concentrated their production reported a significant increase in productivity per hectare compared to before. Thus, despite having smaller areas under cultivation, they regularly produced a surplus, which they sold to raise an income. These households also had the means to rear livestock fundamentally as source of manure needed to fertilize their crops, which had a significant multiplier effect. Thus, 69% of these farmers were able to till their land with the manure from their own cattle, which, in combination with natural pest management practices, cut down the costs of outsourcing such services. On the other hand, income and savings provided them with the resources to regularly use inorganic fertilizers. About 80% of these farmers regularly applied chemical fertilizers in addition to animal manure. In sum, this made the well-equipped households more successful in pursuing the concentration strategy compared to households with fewer assets. In the same vein, the availability of assets also positively influenced the ability of farmers to make the necessary investments to diversify production, thereby effectively responding to emerging market opportunities, for example, the high-price season for vegetables. Thus, concentration and diversification of production nearly always went along with market orientation. As a consequence, well-equipped farmers were well connected to relevant platforms and networks (e.g., tobacco auction floors, milk collection centers, the Grain Marketing Board, millers etc.), which in turn enhanced their competitive market advantage. These farmers reported that most of the money raised from market participation was ploughed back into growing their asset base. They used farm assets as a fallback mechanism, whereby some assets may be sold in difficult times, for example, in a drought year, and restocked once the situation improves. Some farmers in this category were also reported to be building their asset base through off-farm jobs and remittances. This indicates that the well-equipped farmers were often better educated, making it easier for them to find well-remunerated jobs that provide greater flexibility in living a better life while accumulating assets through the activities of the remaining family members on the farm.

In contrast, **farmers without assets** had fewer options to respond constructively to crisis situations. Most critical was their inability to produce manure in sufficient quantities to guarantee productivity on poorer soils even when concentrating their scarce resources. They also lacked the means to investin diversification, which further increased the risk of food shortages in a bad season. Particularly those farmers who oriented themselves towards subsistence farming suffered from low yields. The majority of these farmers produced only what they eat, which was often not enough to see them through to the next farming season. Therefore, many of them started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and illegal mining of gold deposits along river banks, to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in impoverished and intact landscapes. In the other two case studies this strategy was not so much an option of choice because the majority of farmers had assets except for a very few poor households who, out of desperation, turned to exploitation. The exploitation strategy seldom generated enough income to cover the households' needs, so that the farmers without assets often had to look for low-return jobs. However, even the low wages were insufficient to equip the farm with its required assets, and in addition this off-farm activity dramatically reduced the available workforce.

Also, most of the households in the **few assets category** was typically quite poorly equipped. They were only able to produce moderate amounts of the inexpensive manure that was desperately needed to concentrate production effectively. Accordingly, they most frequently reverted to subsistence farming or searched for opportunities to exploit resources outside their farms. However, contrary to households without assets, at least a quarter of them managed to diversify their production and included a variety of food crops, without achieving the productivity rates of well-equipped farmers.

Statistical significance of identified influences

A probit regression of the influence of available farm assets on the household's responses in times of crisis largely confirmed the observations presented above. There were statistically significant differences in the responses of household belonging to the lowest and highest asset categories, particularly with regard to market orientation, concentration and subsistence orientation (Table 18).

Table 18. Probit regression of farm assets and responses

Response	Asset category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Few assets	-2.367e-01	3.717e-01	-0.637	0.5243
‘ ‘	Well-equipped	-1.385e+00	6.352e-01	-2.181	**0.0292***
Concentration	Few assets	0.11280	0.36035	0.313	0.754251
‘	Well-equipped	1.04005	0.44993	2.312	**0.020801***
Market orientation	Few assets	1.07643	0.39755	2.708	**0.006776****
‘ ‘	Well-equipped	1.80715	0.46835	3.859	**0.000114*****
Livestock orientation	Few assets	9.086e+00	6.019e+02	0.015	0.98796
‘ ‘	Well-equipped	-5.827e+00	1.070e+03	-0.005	0.9957
Diversification of production	Few assets	-0.20980	0.46863	-0.448	0.654380
‘	Well-equipped	-1.00676	0.67530	-1491	0.136006
Diversification through jobs & remittances	Few assets	-0.53504	0.90362	-0.592	0.5538
‘ ‘	Well-equipped	-1.32299	1.07184	-1.234	0.2171
Diversification through exploitation	Few assets	-0.6034	0.5581	-1.081	0.2796
‘ ‘	Well-equipped	-0.9455	0.8173	-1.157	0.2474

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found with regard to market orientation. Thus, compared to households with no assets, well-equipped households in particular, but also those with few assets opted for this response in times of crises significantly more often. The probability of market orientation is significantly higher with increasing ownership of livestock, whether small livestock, cattle or both. Households with milk cows were naturally oriented towards milk production, whereas those with cattle, goats, sheep chickens (traditional road runners or broilers), turkeys and guinea fowls more often produced for local markets and their own consumption. Since the risk of agricultural enterprises is so high, well-equipped farmers are much more resilient in responding to crises with market orientation. The analysis also confirmed the capacity of well-equipped households for effective concentration. Finally, the calculations reflected the fact that subsistence orientation is principally a strategy of households with no assets. With regard to all other response types, no statistically significant correlation was found.

4.3.1.2 Farm size

General situation

Farm size is important, as it allow farmers to grow as much not only for their own consumption but also for markets and to rear as large an animal population as the farm's size can accommodate. On the different farms, farmers often combine crops and livestock production, but the quantity is often determined by the size of the farm. Farm size is regarded as important by the farmers because it provides a guide in terms of the choices of which and agricultural commodities to produce and how, but it also raises questions regarding economies of scale and economic viability, particularly for the

small farm sizes in communal areas located in 'in intact and impoverished landscapes.' Farmers in communal areas, as referred to above, do not have sufficient grazing areas to support the draught cattle they require for their crop production. In contrast, farmers in the other two case studies located in the 'small-scale farms and resettlement area' have sufficient grazing areas for their cattle, thereby sufficiently supporting their draught power. In the context of the case studies, farm sizes were particularly critical for farmers who wished to increase production and engage with markets, and they also increased livestock, not only for draught power, but also for a variety of other purposes, as mentioned in the section on farm assets above. In the small-farm case studies in communal areas located in 'impoverished and intact landscapes', farm sizes are compromised by the increase in land degradation over the years, which further reduces the areas of already small farms on which crops can be grown. This is further compounded by the insufficient grazing area, which limits livestock per household, consequently reducing households' draught power and their capacity to produce the much-needed inexpensive fertilizers for their crops.

In general, productivity was very low in the analyzed households in communal areas located in the 'impoverished landscape' with highly degraded soils. About 62% of the households with small farms opted to further reduce the size of their cultivated area by concentrating their scarce resources on their most suitable land. Interestingly, about 10% of households in communal areas located in the 'impoverished landscape' oriented themselves towards the market, while in the medium-size farms located in the 'resettlement area', more than a third of households became market-oriented, and double that number of the larger farms turned to market orientation. The '**large'** farms were found only in one case study ('small-scale farms'), in which farmers had landholdings measuring between 40 and 240 hectares per household. Such farms were significantly larger than the other two categories. With large farms, the majority of households combined food, cash crops, and a mixture of dairy and draught cattle production on one farm. Although the study observed a general trend across the four case studies to adopt the reduction, concentration strategy, farmers in the 'small-scale farms' case study had the highest cultivated areas in hectares and more cattle, mostly dairy cows, than the other two categories. The farmers in the case study located in the 'resettlement area' had equal farm sizes measuring six hectares per household, with access to grazing land. On these six hectares, farmers could effectively allocate areas for food and cash crops and produce more than their counterparts in the communal areas. The provision of a stand-alone grazing area enabled farmers in this case study to grow their cattle stocks, not only providing them with draught power but also traction for other purposes already mentioned in the farm assets section.

Productivity was reported to be low among farmers with ***'small farms'***, as they were constrained by dwindling cultivable land due to degraded soils, a growing population and the increased demand for land. However, households with small farm sizes benefited from communal collaboration, which saw them establish irrigation schemes where farming was concentrated. This eased the lack of space in densely populated communal areas located in the 'intact landscape', while concentrating production on the most suitable land helped households who practice dryland farming, particularly in the two case studies in communal areas located in 'intact and impoverished landscapes.' In so doing, farmers allowed longer fallow periods, resulting in the natural regeneration of tree species and grass, thereby creating some new ecosystems and enabling them overcome the challenge of the lack of grazing areas, as some turned the areas left fallow into paddocks for their livestock. For example, households with fallow fields protected them by putting up a fence or leaving a natural fence to safeguard it from straying animals. The majority of farmers who practiced dryland farming in the two communal case studies located in intact and impoverished landscapes adopted some conservation farming practices by confining their production to the most suitable areas and using grass from fallow fields to mulch their crops. Conservation farming techniques were mainly practiced in the two communal case studies. Households that adopted the full principles of conservation farming reported increased area productivity on the small plots. In situations of crisis, it was common practice for farmers to reduce the area of cultivated land across all four case studies. However, the size of the cultivated land differed distinctively between small and medium, and medium and large farms. This reduction was done in

order to concentrate the scarce resources on the most suitable land with the hope to increase productivity, as farming was intensified using the available resources, particularly inexpensive animal manure.

The farmers in the ***medium-size farm category*** had larger farms than those in the communal-area case studies, but similarly had access to common grazing. To a certain extent this was a limiting factor in relation to the number of cattle a household could have based on its carrying capacity. Nevertheless, the animal population in this category was found to be much more commensurate with the larger grazing areas than for the case studies in communal areas. Secondly, in three out of the eight villages in this category, grazing areas were allocated to new farmers, leaving no grazing land at all, thus reducing the arable land for the affected households and consequently forcing them to reduce their herd size due to the lack of grazing area. These reductions in herd size also had negative consequences in reducing draught power, manure and productivity. Although the lack of draught power in this case study may be met by using tractors, not all households could afford to hire a tractor, justifying their preference for keeping sufficient draught cattle for their crop production. Households' situations regarding farm size were strongly correlated with just one personal analyzed feature (Table 19)

Table 19. Spearman correlation coefficients between farm size and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Farm size	0.36	1.00	0.14	-0.07	-0.08	0.16	-0.60	**0.01***	0.18	0.09	0.21	-0.01

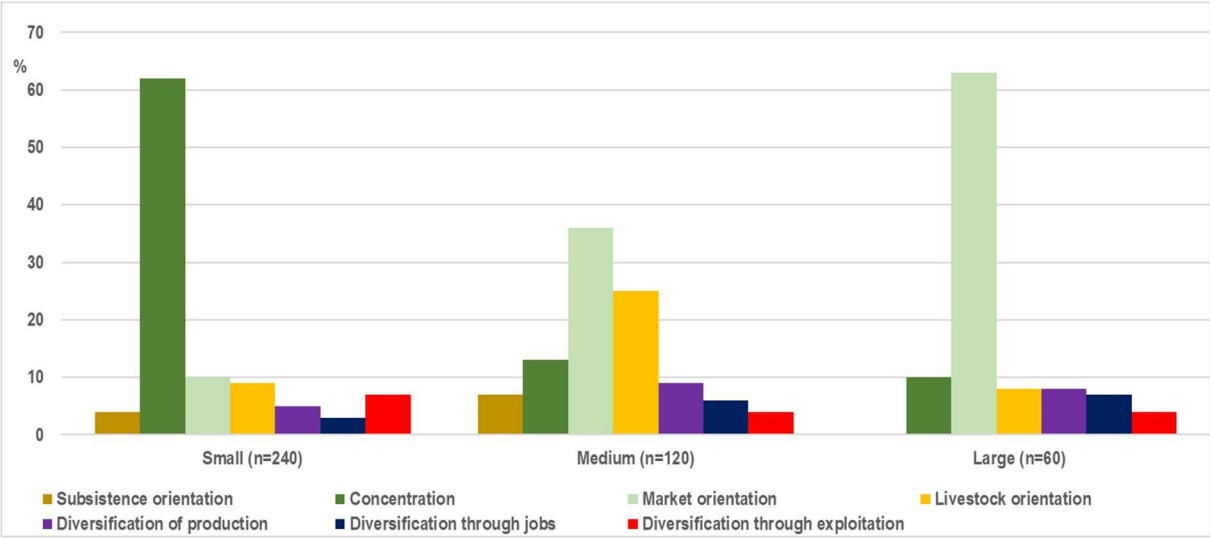
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, farm size was positively correlated with the farming experience of the household head. For example, milk producers largely consisted of farmers with more experience in the field of milk production and engagement with the market. Farming experience was passed down the generations, as current farmers mostly formed a third generation that had been born, lived and worked on the farming enterprise with their elderly or late parents. Also, farmers with more experience were more resilient to changes in rainfall patterns by choosing drought-tolerant crops andlivestock varieties, adopting farming practices that helped retain moisture for longer periods and improving soil fertility using inexpensive animal manure more than they used to do before. Also, extension services showed a trend towards significance, but fell just short of statistical significance. For example, farmers in large farms in the case study located in 'small-scale farms' had reasonable access to extension services for advice on both extensions and animal husbandry.

Responses

Households belonging to the three different farm-size categories showed strongly different response patterns (Figure 17). The households in the case study of small farms in communal areas located in 'intact and impoverished landscapes' showed a wide range of responses to crises. Most frequently, such households concentrated their production, while other strategies were less frequent. Of the less frequent strategies, some households in this category started to engage with markets, others turned to livestock production, while yet others started to exploit resources, diversity their production, diversify through jobs or switched to subsistence farming. In contrast, (re)orientation towards markets was most frequent in the large case study located in 'small-scale farms', though the other responses were also less frequent. For these farmers, other responses played hardly any role. Accordingly, households in the intermediate farm-size category showed a mixture of these two patterns. They showed all type of responses, however, less accentuated.

Figure 17. Proportion of farmers' responses to crises by farm size categories



The households with **large farms** managed during crises to continue and increase their participation in markets through the production of milk and tobacco. Milk production is by and large the most frequent strategy for these farmers, followed by tobacco production. Before 2000, the farmers in this area used to grow maize as both a food and a cash crop, but producer prices fell, discouraging the majority of farmers except for a few. As such, the production of maize as a cash crop had already declined some years before the start of the Zimbabwean crisis, as the government continued to control its price on the market, prompting farmers to stop producing it for the market and growing it only as a staple crop and for livestock. Consequently, this reduction in maize production led to some farmers in this area switching to tobacco production, which had better returns than maize. Livestock production in this category is reported to have increased significantly over the years, particularly milk cattle due to the grazing areas they have available on their self-contained farms. With large farms, farmers reported to have allocated areas to fodder production which they stated had improved the quality of their livestock, with ripple effects particularly for milk producers, whose quantity and quality of production consequently improved as well.

In contrast, households with **small farms** responded by concentrating their production, though with less engagement in the market. Most critical was their ability to produce sufficient food for their families by concentrating their scarce resources. The majority of farmers who turned to tobacco farming did so at the neglect of growing food crops due to the limited amount of land that could effectively combine food and cash crops on their small farms. If the quality of the tobacco produced was unacceptable, this often meant a major loss and suffering for the affected household. In preferring tobacco over maize, the household banked on realizing high returns from the sale of tobacco which could later be used for food and other requirements. The failure to produce enough food to feed their families on their small land parcels led to some farmers starting to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in 'impoverished and intact landscapes.' Rarely did the exploitation strategy generate enough income to cover the households' needs, meaning that households with small farms often had to look for low-return jobs outside their rural settings. This off-farm engagement dramatically reduced the existing household workforce.

The **medium-size farm category**, in contrast to the larger farm owners, engaged with the market mostly through tobacco production, very few doing so through maize production. Farmers in this category turned to livestock orientation, as they have grazing areas that are larger than those found in the two case studies in communal areas, which also access common grazing land. However, the

continued allocation of land to new farmers on land previously earmarked for grazing purposes pose challenges for the affected households. Consequently, the area of land available for growing crops is reduced, as the affected farmers have to graze their livestock on land allocated to farming activities. As with the other categories, the other strategies were emphasized less except for those who concentrated their production. Concentration of production in this category was a response to the non-availability of affordable inputs and not farm size.

Statistical significance of the found differences

A probit regression of the influence of available farm size on a household's responses in times of crisis revealed no statistically significant relations to the adopted strategies (Table 20).

Table 20. Probit regression of farm size and responses

Response	Farm size category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	medium	-3.467e-03	4.101e+03	0.000	1.000
' '	large	8.104e-01	4.988e+01	1.621	0.1049
Concentration	medium	0	0	0	0
'	large	-0.19003	0.273448	-0.695	0.487142
Market orientation	medium	-0.04995	0.45989	-0.109	0.913515
' '	large	-0.52512	0.27006	-1.944	0.051842.
Livestock orientation	medium	2.672e-02	4.112e+03	0.000	0.99999
	large	4.476e+00	4.530e+02	0.010	0.99212
Diversification of production	medium	-0.54578	0.35054	-1.557	0.119479
'	large	-0.50982	0.30059	-1.696	0.089878.
Diversification through jobs & remittances	medium	0	0	0	0
' '	large	1.04021	0.56057	1.856	0.0635.
Diversification through exploitation	medium	0	0	0	0
	large	-0.3254	0.4785	-0.680	0.4965

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Although no statistical significance on the influence of farm size was revealed by the probit regression, market orientation stands at the margin of statistical significance. Thus, compared to households with small farms, those with large farms in particular, but also those with medium farms opted significantly more often for this response in times of crises. The probability of diversifying production fell just short of statistical significance, as was the probability of diversifying through jobs and remittances. With regard to all other response types, no statistically significant correlation was found.

4.3.1.3 Land tenure

General situation

In Zimbabwe, land ownership and distribution remain a major source of conflict, having also been at the center of disputes in pre-colonial days. For Zimbabwean farmers, land tenure is important for the enjoyment of sustainable livelihoods through the accumulation of farm assets and investments on land. Thus, land tenure provides for the relationship which farmers have with regard to land and natural resources, such as forests, pastures, minerals and water. Land tenure is considered an important rule showing property rights to land are allocated, transferred, used and managed. Against this backdrop, farmers explicitly view land tenure as crucial for economic growth and an incentive for investment. Therefore, insecure tenure systems disrupt economic activities and discourage affected farmers from investing in their farms. In the context of the case studies, land tenure was particularly critical in defining the relationship farmers had with the land on which their livelihoods hinged. In the case studies, different land tenure systems exist, each with their own advantages and disadvantages: for example, the '**customary systems'** used in the case studies located in 'intact and impoverished landscapes' are based on traditional, collective, informal and locally relevant rules specifically on the use and allocation of land and other resources, such as grazing areas, forests and sources of water. Customary tenure also facilitates social cohesion, as community members often work together for a

common end, hence the term 'collective society' is often used to describe the cooperating communities. However, the disadvantages of this system often rest on its failure to withstand the increasing pressure on land and/or other resources, which, if not well managed, might result in a tragedy of the commons through the overexploitation of resources. The other land-tenure systems used in the other two case studies 'small-scale farms' and 'resettlement area' are more individualized and formal systems.

Farmers with '**freehold'** (private or individual) land-tenure systems were found in one case study located in the 'small-scale farms.' These farms were created exclusively for the native population through the 1930 Land Apportionment Act. With freehold tenure, farmers have individual ownership of the land they live on and title to the property. The land title guarantees these farmers exclusive property rights, full control and responsibility not only for the land they own, but also for the natural resources around their farms and infrastructure. As they had property rights, farmers in this category were able to sub-divide and allocate land to their adult sons, while where no such sub-divisions were made, the oldest or youngest son inherited the land from their parents. The household survey of this category showed that the majority of farmers are the third generation of farmers in their families. Although all farmers were struggling during the Zimbabwean crisis, the farmers in the freehold category were trying to use their land in the most economically efficient way.

In contrast, farmers with **leasehold** tenure have rules defining who holds the land and who can use the resources for what period of time and under what conditions. The leasehold rules may be well defined or ambiguous, with the latter being prone to misinterpretation and/or exploitation. Farmers in this category of land tenure are the beneficiaries of the land redistribution program of the early 2000s, which the government launched as a way to decongest the communal areas. Consequently, a variety of people, not only farmers from communal areas, benefited, including businesspeople, former civil servants and war veterans. In the case of the leasehold tenure system, farmers were issued with offer letters from the lands office giving them formal user rights with a 99-year lease. The offer letter sets out the conditions of the offer. The contents of the offer letter, for example, give the District Land Committee the right to withdraw the offer without compensation, and farmers are not allowed to build permanent structures, which in turn creates insecurity among them regarding their ability to stayon the farm permanently. This was further compounded by farmers not having been issued with offerletters and double allocations of some farms in some instances. Leasehold is governed under the Lands Commission Act. However, at both the provincial level through the lands office and the government level, conflicts that arise from the contents of the offer letters have not been resolved, nor have the issues of double allocation and boundary disputes. The situation of households with regard to land tenure was found to be correlated with some of the other personal, and institutional features analyzed (Table 21).

Table 21. Spearman correlation coefficients between land tenure and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Land tenure	0.37	1.00	0.14	-0.08	-0.07	0.17	-0.15	**0.01****	0.18	**0.09**	0.21	-0.01

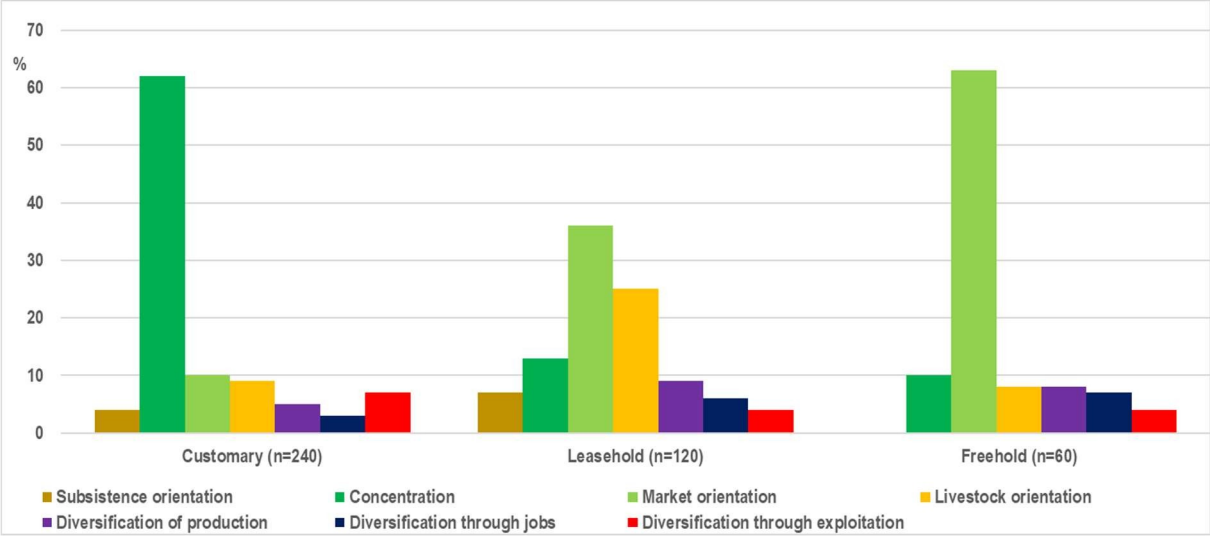
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, farm size was positively correlated with land-tenure systems. Thus, having a large farm size was more likely in the case of freehold (private) tenure systems, while small farm size was more likely with customary tenure arrangements. Another strong correlation existed between land tenure and farm experience. For example, freehold tenure was more likely to be held by more experienced farmers, as they are located near schools, colleges and universities. Extension services exhibited a certain trend towards significance, while for the other features there were no significant correlations with land tenure.

Responses

Households belonging to the different land-tenure categories showed strongly different response patterns (Figure 18). The households with freehold tenure rights showed a wide range of responses to crises. Most frequently, such households oriented themselves towards markets, while other strategies were less frequent. None of the households in this category switched to subsistence farming. In contrast, households under customary tenure systems most frequently concentrated their production. For these farmers, the other responses were less frequent. Accordingly, households in the intermediate leasehold category showed a mixture of these two patterns. They showed all type of responses, though these are less accentuated.

Figure 18. Proportion of farmers' responses to crises by land tenure categories



During crises the households with **freehold** tenure rights managed not only to invest into production for their own consumption, many of them even started to produce cash and food crops intensively for the market. Particularly those farmers who produce milk and tobacco reported some significant increases in daily milk deliveries and hectares under tobacco cultivation compared to earlier. Thus, despite the challenges of the Zimbabwean crisis, farmers were able to adapt their land to the most economically efficient uses through crop and milk production. These farmers reported that most of the money raised from market participation had gone on making investments in the farm. They are incentivized to do this because of the tenure system, which guarantees them exclusive property rights. This indicates that freeholders are more secure and have more flexibility in living a better life on land which they formally own. For this reason, about 1% of farmers were able to access bank loans using their farm property as collateral. Farmers under this tenure category, however, expressed a reluctance to take out bank loans because of the high interest rates. Although their property would be accepted as collateral, farmers resorted to other local sources of loans than banks, including a revolving fund established with the help of STABEX and a local donor through which farmers access loans at zero interest. Apart from the dairy association, which bring farmers together around milk production, here farmers mostly work individually on their respective farms.

In contrast, **customary tenure rights** gave farmers more options to come together and work together in response to crisis situations. Most critical was their ability to identify and establish irrigation projects allowing them to concentrate their scarce resources. Farmers who concentrated their production in this way reported increased area productivity and also cooperation and support from other community members with irrigation, as they then work collectively in producing food for their families. The concept of labor collaboration increased, especially in the case study located in 'intact landscape', as community members came together strongly in response to the Zimbabwean crisis. Also, farmers not included in irrigation projects often pooled their efforts, with some communities establishing '**seed banks**' to provide seeds to community members at the start of the rainy season. This indicates that

communal-area farmers are more collectively minded and in crises became even stronger by cooperating in food production for their families. This covers all members and at times non-members, as seeds were reported as being distributed to vulnerable households in villages as a way of encouraging them to work with others. Labor is easily pulled in for tasks such as preparing land for cultivation, planting, weeding, harvesting and threshing small grains, more than was the case before. While customary systems of tenure tended to facilitate social cohesion much more than before, farmers reported on the subsequent overcrowding, resulting in environmental degradation. In contrast to freehold tenure, systems of customary tenure do not respect the property rights of farmerswho have lived on the land for generations, particularly when decisions regarding development projects are made. This was particularly true for the community in the case study located in 'impoverished landscape', where land was expropriated without compensation by the rural district council to expand the provisional town. Farmers in the area responded to this by exploiting the naturalresources around their fields first, more than once overexploiting them from within their farms.

In contrast to freeholders and customary tenure systems, households in the **leasehold category** had rather restrictive permit systems barring them from constructing permanent structures, nor could the farm be sold, and it can even be withdrawn by the issuing office without compensation. Suchconditions create uncertainty about farmers' ability to stay permanently on the farm and thus discourage them from investing in the land. Despite these uncertainties, the study found that most households had erected houses constructed from bricks and metal sheeting for the roof. Some also invested in drilling boreholes to irrigate their crops, while others have installed solar panels, especiallythose households without an electricity supply. They also reported several conflicts arising, ranging from double allocations of farms to boundary disputes to grazing area disputes and households lackingpermits, cases that were brought before the government, without ever having been resolved. Farmersin this tenure category are actively engaged with the market but not at the same frequency as freeholders, though some have oriented themselves towards livestock as a source of their income, which they can easily convert into cash, particularly due to their nearness to slaughter houses in urbancenters. The allocated grazing areas promoted the accumulation of cattle in this case study more than the majority of communal farmers could do before they were resettled. However, three villages out ofeight in this tenure category had their grazing land converted into farms that were allocated to new farmers in 2016. As they only have formal use rights over the land on which they settled, they could not challenge the decision of the land office. At the level of the individual household, farmers had to decide how much cattle to keep on their farm in the absence of grazing land. This tenure system increases uncertainty and discourages farmers from making investments in their farms for fear that the land might be expropriated in any case.

Statistical significance of the differences identified

A probit regression on the influence of land tenure on households' responses in times of crisis revealed some statistically significant relations, particularly with regard to the concentration, market orientation and diversification of production (Table 22).

Table 22. Probit regression of land tenure and responses

Response	Land tenure category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	freehold	-0.070135	0.291199	-0.241	0.8097
Concentration	freehold	1.117085	0.435126	2.710	**0.00674****
Market orientation	freehold	-1.42568	0.36720	-3.883	**0.000103*****
Livestock orientation	freehold	0.61935	0.52279	1.185	0.23613
Diversification of production	freehold	-0.884641	0.251460	-3.518	**0.000435*****
Diversification through jobs & remittances	freehold	0.65072	0.46176	1.409	0.158769
Diversification through exploitation	freehold	-0.276026	0.328825	-0.839	0.4012

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found in levels of concentration and market orientation. Thus, compared to households with customary tenure, they more often opted for concentration, while households with freehold tenure arrangements or leasehold opted significantly more often for market orientation in times of crisis. The probability of concentration is significantly higher with customary tenure systems than with the other two systems, and market orientation is significantly higher with freehold and leasehold tenure. The analysis also confirmed the probability of diversification of production being significantly high with freehold and leasehold compared to customary tenure systems. With regard to all other response types, no statistically significant correlation was found.

4.3.1.4 Remoteness

General situation

Remoteness is important, as the farmers located further from markets find it expensive to engage with markets. Transaction costs are a major deterrence for remotely located farmers wanting to participate effectively in markets. This was particularly true for farmers in communal areas in the case studies located in 'intact and impoverished landscapes', although the latter could engage with markets, but only at low frequencies, in contrast to those located nearer to markets. In order to reduce transaction costs, households in the case study located in 'impoverished landscape' mobilize transport collectively, which turns out cheaper than when they hire individually. While all the surveyed households expressed an interest in engaging with markets as a way to generate much needed cash, households located further away turned to local markets to sell their produce and skip the costly transport costs. In order to earn some income from farming, households located in remoter areas grow only the products in demand in their area in order to avoid losses. By contrast, those households located nearer a market took the opportunity presented by the crisis to grow niche crops like potatoes and types of vegetables that they can sell to supermarkets, traders and the major markets. Farmers located nearer a market in the case study 'small-scale farms and resettlement' were induced to produce for the market due to the relatively low transportation costs involved. Thus, diversifying production became an option for some households located nearer markets, giving them a wide number of products to sell, sometimes even at the farm gate. Given the high costs of transport and corrupt police mounting road blocks, farmers and traders end up paying a lot on the road, thus reducing there otherwise minimal profit, so traders greatly preferred shorter distances to long ones. Thus, more traders were cooperating with farmers located nearer markets than those further from them.

The households located nearer to markets engaged with them more than those located farer. Such '**nearer'** farmers were found mostly in two case studies ('small-scale farms and 'resettlement'). In the 'small-scale farm' case study, farmers were about 42 km from a market, the resettlement farmers about 54 km from one. They are also located close to the business center and district town, both within distances of less than ten kilometers. These short distances meant that farmers can easily transport their farm produce to the nearest market, while customers who prefer to buy straight from the farm can access these two case studies with ease. The farmers in the two case studies in 'small-scale farms and resettlement' were able to cope with crises more effectively by actively engaging with markets.

In contrast, those households located **further** from markets were also able to effectively cope with the country's crisis by concentrating their production, which provided them with enough food for their own consumption and a surplus which they sold to raise an income. About 5% of households located further from markets who actively engaged with them had a market orientation as their main source of income. The situation of households with regard to remoteness was strongly correlated with some of the other farm, personal and institutional features that were analyzed (Table 23)

Table 23. Spearman correlation coefficients between remoteness and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Remoteness	**0.04***	0.14	1.00	-0.08	-0.10	**0.01***	-0.01	-0.06	**0.07**	0.76	0.60	0.16

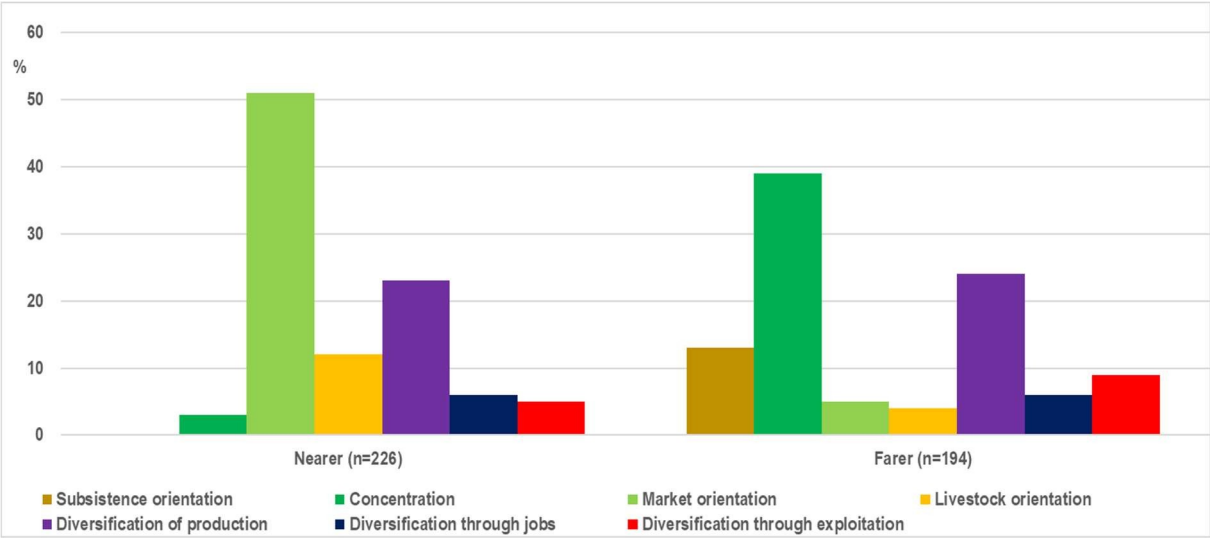
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, remoteness was positively correlated with the educational level of the household head and the farm's assets. For example, the frequency of highly educated household heads was high among households located nearer markets than those located further away. Also, households located nearer markets were better equipped with assets than households located further away. Thus, nearness to markets provides an opportunity for households to aggregate their asset base with less transport costs than those located further off. Also, financial situation was on the margin of statistical significance to remoteness. The probability of rich households increases with increasing nearness to markets.

Responses

Household belonging to the different remoteness categories showed strongly different response patterns (Figure 19).

Figure 19. Proportion of farmers' responses to crises by remoteness categories



The households that were located nearer to markets showed a wide range of responses to crises, thus markets opened up entrepreneurial spaces and choices for farmers. Most frequently, such households oriented themselves towards markets or diversified their production, while other strategies were less frequent. None of the households in this category switched to subsistence farming. In contrast, the concentration and diversification of production were by far the most frequent responses on the part of farmers located further from markets. For them, other responses played nearly no role.

The households that are located **nearer to markets** engaged with them more while at the same time producing their own food. This enabled them to raise an income from the sale of farm produce while saving money by only buying items that they do not produce through their farming, such as salt, sugar, clothing and other household items. They often used the money raised through the sale of tobacco, milk and maize to expand their production, increase their farm assets and thereby improve their well-being even in the midst of the Zimbabwean crisis. Diversification of production served two purposes for the households in this category: to increase the variety of food available to the household, and also for sale, thereby spreading the risk. For example, if the market is flooded with tomatoes and onions, a diversified household growing carrots, eggplant, peas, sorghum and millet mealie-meal may earn better returns on the non-flooded items than the flooded items. Often, farmers are forced to reduce the price of their produce, especially perishables, when the market is flooded. While the other responses played almost no role in this, livestock orientation provided households in this category with draught power, manure and cash, which also complemented their efforts to diversify production and increase productivity.

For the households located **further** from markets, during crises they managed not only to invest in produce for their own consumption but also to grow a surplus. In particular, those farmers who concentrated their production reported a significant increase in productivity per hectare compared to earlier. Thus, despite being remotely located, they regularly produced a surplus which they sold on local markets to earn an income. Remoteness affected their active participation in markets due to the prohibitive transport costs. Accessibility was also a challenge for households located further from markets, some households not being easily accessible, as they lived in mountain areas with no roads. For such households it is extremely difficult to bring their produce even to a road for further transportation to a market, hence they are completely closed off from market participation. Only about 5% of the households in this category were involved in markets. Being further away from markets also means that obtaining inputs is expensive, limiting the capacity of farmers to increase productivity, let alone produce a surplus for the market. Due to these difficulties, households in this category turned to diversifying their production to increase the food available to the household. This was especially important as a response to changed weather patterns, as these farms grew more drought-tolerant varieties, thereby spreading the risk across a number of crops types. For example, inthe event of a drought the maize crop might be write off, but small grains in the form of sorghum, pearl and finger millet are tolerant to drought. Households that had diversified would therefore still be able to harvest something in a drought year than only maize. Households in this category also copedwell with crises by switching to small livestock, which are more resistant to drought than cattle. In so doing, these households optimized their capacity to respond to crises through diverse forms of intensification exploiting early-maturing crop varieties, small ruminants (goats and sheep), chickens, turkeys and guinea fowls. Subsistence orientation was adopted by very poor households, who grew crops only to feed their families, always assuming that they managed to produce enough. However, inmany cases among such households they only produced food enough for a few months, after which they would have nothing more in their granaries. Acting out of desperation, they started to exploit natural resources for own consumption, starting with those available within their surroundings before extensively exploiting them further afield.

Statistical significance of the differences identified

A probit regression on the influence of remoteness on households' responses in times of crisis revealed some statistically significant relations, particularly with regard to market orientation and concentration (Table 24).

Table 24. Probit regression of remoteness and responses

Response	Remoteness category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	nearer	-2.569e-01	3.142e-01	-0.818	0.4135
Concentration	nearer	-0.7153	0.3287	-2.176	**0.0296***
Market orientation	nearer	-1.336399	0.317798	-4.205	**2.61e-05*** **
Livestock orientation	nearer	-3.7719	501.68732	-0.008	0.994
Diversification of production	nearer	-0.30224	0.47534	-0.636	0.524874
Diversification through jobs & remittances	nearer	-0.61926	0.70865	-0.874	0.3822
Diversification through exploitation	nearer	0.9152	0.6041	1.515	0.1298

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found with regard to market orientation. Thus, compared to households located further from markets, those located nearer opted significantly more often for this response in times of crisis. The probability of market orientation is significantly higher with increasing nearness to markets. The analysis also confirmed the statistical significance of concentration for households located further from markets. Finally, the calculations reflected the fact that subsistence orientation is a strategy principally of households located further from markets. With regard to all other response types, no statistically significant correlation was found.

4.3.2 Personal features

4.3.2.1 Age

General situation

The age of the household head was important for the decision-making behavior of farmers in response to the Zimbabwean crisis. Under conditions of uncertainty, limited options and emotions, age impacted on the decisions of household heads differently in terms of the strategies they opted for. It is often difficult to keep young farmers on the farm when they imagine the grass is greener elsewhere, especially when they fail to produce enough food for their families or to earn an income from farming. Hence, rural to rural or rural to urban migration becomes an option of choice, especially for young and middle-aged householders, who, in the event that they find a remunerative job, will continue to support the remaining family through remittances. With dwindling resources, employment opportunities also declined, though those who migrated to urban centers often end up engaging in a variety of non-farm activities to earn a living. The older households often choose to stay put on the farm, mostly due to the attachment they may have with their land and the experience they may have acquired over the years. Adult children often move out from the parents' home to start their own life, usually on land divided off by their parents. The preferences of the different age groups differ in terms of the responses they may make in times of crisis.

In difficult situations, **young** household heads are more likely to start seeking satisfactory solutions as such migrating to other farms, urban centers or even abroad in search of remunerable employment, and to explore exploitative options such as illegal gold-mining, wood collection, and brick-making, regardless of whether it leads to benefits or not. However, while migration in search of jobs injects much needed cash into boosting rural economies, it creates labor shortages (both skilled and unskilled), placing a great burden on women, children and the elderly in terms of increased workloads, as well as reducing the rural population, which again affects the development of rural economies. Illegal gold mining was mostly used by young people from poor households, but it still makes only very low returns. Such strategies not only degrade the environment but place young people in a vicious cycle of poverty, as almost all of the households surveyed that had children doing exploitation activities, the children skipped going to school before ultimately pulling out completely. Not all young people respond this way: others opt for market orientation using their lived experience on the farm to compete with their elders in producing not only food for their families, but also cash crops for purposes of making a profit from their farming business. Some of them also diversify their production to include a variety of crops other than those young farmers their age produced previously.

In general, '**older'** farmers mostly remained on their land due to their attachment to it, but also due to old age, their options being much limited than those of young people. The majority of old farmers have a long history of crop and livestock production, which increases their adaptability to harsh climatic conditions, hence most of them opt to concentrate their production. Most such farmers were found in a case study located in communal areas in 'intact landscape'. They mostly concentrate production in irrigation projects or the most suitable land, where they practice dryland farming. Older farmers in communal areas in a case study located in 'impoverished landscape' have re-oriented themselves towards subsistence farming. They mostly attribute this move to the scarcity of resources and the costly inputs, but also to a loss of energy, short-term planning and a general fear of taking risks with regard to, for instance, market orientation or the loss of capital invested in the strategy due to market failure. For those who consider there are benefits from market orientation and were willing to take risks, they started growing cash crops like tobacco and thus became actively engaged with the market. There is a greater tendency among older farmers to orient themselves towards livestock production, not only as a badge of rural wealth, but also to provide draught power, cash and manure, as the costs of farming kept skyrocketing beyond the means of poor-resourced farmers.

The farmers in the ***middle-aged category*****,** in contrast to the young and old, more often respond by diversifying their production. This gives them the leverage to produce more for the family, including a diverse diet, while they can also use a diversification strategy as another if not the main source of

earnings. For example, they diversify into the production of a variety of vegetables, small grains, fruits and livestock, particularly small livestock, which are easier to convert to cash than cattle. Such households could therefore also seek satisfactory solutions by finding remunerative employment and/or exploitative activities, but their frequencies of doing so in comparison with the young households were low. The decision-making behavior exhibited by the household heads in this category differed from that exhibited by other age groups, particularly in re-orientating their activities towards subsistence farming (older category) or diversification through jobs and remittances (young category). The situation of households with regard to the age of the household head was strongly correlated with one of the personal features analyzed (Table 25).

Table 25. Spearman correlation coefficients between age and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Age	-0.04	-0.07	-0.08	1.00	0.08	-0.02	**0.02***	0.67	-0.06	-0.13	-0.10	-0.03

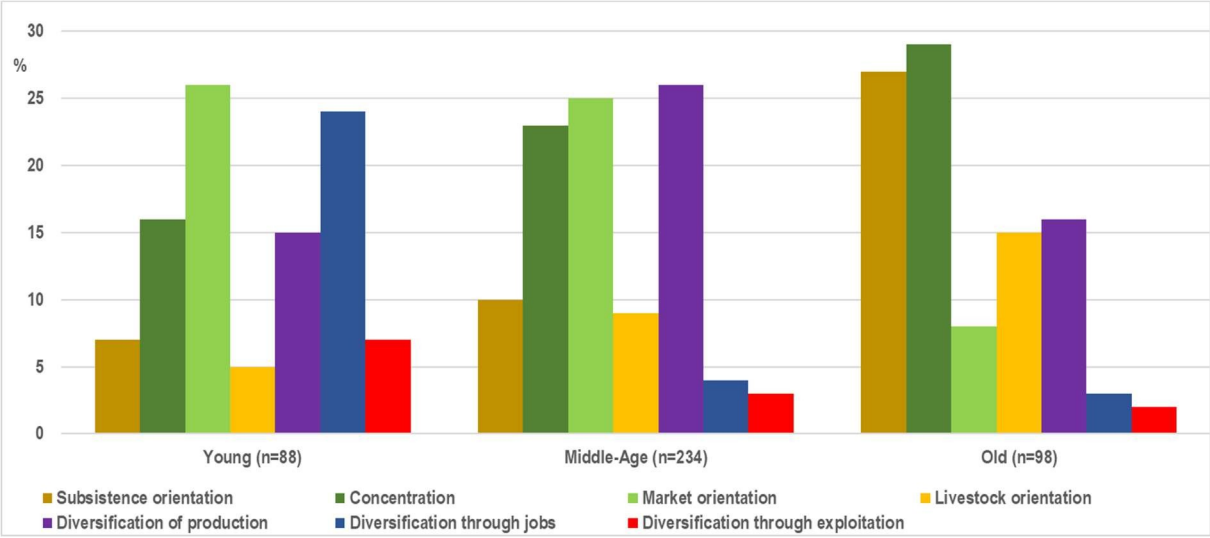
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, family size was positively correlated with seeking remunerative employment, with a majority of small families having an absent husband supporting both on-farm and non-farm activities through remittances. Also, the option to orient towards the market was more likely for younger male household heads than with females. In contrast, large family households tended to stick together when engaging in exploitative activities for purposes of their survival. Another strong correlation existed between age and gender, although the significance is at the margins of statistical significance. Thus, the option to migrate is more probable with a young or middle-aged male household head than with female-headed households. There were, however, no significant correlations with the other features.

Responses

Household belonging to the three age categories showed strongly different response patterns (Figure 20).

Figure 20. Proportion of farmers' responses to crises by age categories



The households with older members showed a wide range of responses to crises. Most frequently, such households concentrated their activities, switched to subsistence farming, diversified their production systems, or oriented themselves towards livestock production. The frequency of market orientation, though not very much accentuated, was somewhat higher than the other three strategies, which were less frequent. In contrast, market orientation and diversification through jobs and remittances were by far the most frequent responses of young farmers. The second and third most frequent responses in this category were concentration and diversification of production. The other responses were less frequent. Accordingly, households in the intermediate asset category showed a

mixture of these two patterns, with the most frequent responses being diversification of production, market orientation and concentration. The other responses were, however, less accentuated.

During crises, **older** household heads managed not only to invest in production for own consumption: a few of them even starting to produce cash and food crops intensively for markets. Particularly those farmers who concentrated their production reported a significant increase in productivity per hectare compared to before the switch. Thus, despite their old age, they regularly produced a surplus which they sold to raise an income. These households also had the means to raise livestock, fundamental as source of manure needed to fertilize their crops, which had a significant multiplier effect. Thus, having their own cattle, in combination with natural pest-management practices, cut down the cost of outsourcing such services more than before the Zimbabwean crisis. The older farmers, mostly among the poor households, re-oriented themselves towards subsistence farming, which was in line with short-term planning to satisfy their immediate survival needs, but did not sufficient to see them through to the next harvest. Thus, concentration and diversification of production nearly always went along with market orientation. A very insignificant number from this category were reported to be employed, majority of them nearing retirement age, after which they would join the family full-time. Those households whose household head was working off-farm reported that most of the money earned from wage employment and market participation was being used to make farm investments, particularly the case studies located in 'small-scale farms, resettlement area", and the community in impoverished landscapes.' Those from the case study located in 'impoverished landscape' reported remittances being used to meet household basic requirements: there was no excess to use for any investments on the farm. Due to old age and a loss of energy, a very low number in this category opted for exploitation. The frequently observed strategy to reduce and concentrate inputs on the most suitable pieces of land produced some positive social and environmental benefits.

In contrast, **young** household heads responded by orienting themselves towards markets. Thus, unlike most elderly farmers, who are risk-averse, young farmers took this risk and were seen to be more willing to participate in markets, even though the diversification of production gave them even more variety of produce for the markets. Although they do not have much experience, the majority of these farmers reported using the knowledge and skills they had acquired from spending their childhood on the farm and imitating more experienced farmers, while others resorted to trial and error. Those that used imitation and trial and error reported having made losses at the beginning but still used these practices as a learning curve, since when they had been producing better quality and larger quantities of farm produce than they had before. Due to their relatively young age, some of them turned to diversify through jobs and remittances, particularly households located nearer to urban centers. Young people not only looked for employment but also other off-farm income activities in urban centers. The young households that were surveyed indicated that the members who migrated to urban centers were regularly remitting income back home which would be used to expand production and build assets as families that were independent from their parents. In terms of concentration, this category had fewer means of producing enough manure, which weakened their process of concentration, which in turn further increased the risk of food shortages, particularly in a bad season. Particularly those farmers who oriented themselves towards subsistence farming had low yields. Most of them produced only what they eat, which was often not enough to see them through to the next farming season. Therefore, many of these farmers in this category started to exploit resources outside their farms, such as brick-making, wood collection, streambank cultivation of vegetable gardens, and illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in "impoverished and intact landscapes". In the other two categories this strategy was not so much an option because the majority of farmers have assets, except for a very few poor households who turned to exploitation out of desperation. The exploitation strategy seldom generated enough income to cover the household's needs, so that the young farmers, especially the less educated ones, often had to look for low-paid jobs. However, the low wages were also inadequate to provide them with much needed cash, and this off-farm engagement dramatically reduced the available labor force.

Also, the households in the **middle-aged category** were typically diversified farmers who produced a variety of crops not only for their own consumption, but for markets too. Their engagement with markets is confirmed by the high frequency of households who oriented themselves towards markets. In contrast to young farmers, middle-aged household heads had a high frequency of farmers pursuing concentration. Relative to this high proportion of such farmers were those households that oriented themselves towards livestock production. Livestock production is important not only as a source of income and draught power, but most importantly for the production of much needed inexpensive fertilizer for their crops. Such manure was effective in concentrating production, with a majority of farmers reporting an increase in area productivity. Unlike those in older age categories, where a large number of farmers re-oriented themselves towards subsistence farming, there were significantly fewer farmers in this category who opted for subsistence farming. Such households were only able toproduce moderate yields due to the lack of manure or an inability to produce as much of the important inexpensive manure needed for effective subsistence farming. Accordingly, they most frequently sought for opportunities to exploit resources outside their farms. However, contrary to households without assets, at least a quarter of them managed to diversify their production enough to grow a variety of food crops, though without achieving the productivity of better equipped farmers.

Statistical significance of the found differences

A probit regression on the influence of available age on households' responses in times of crisis revealed some statistically significant relations, particularly with regard to market orientation, concentration and subsistence orientation (Table 26).

Table 26. Probit regression of age and responses

Response	Age category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Middle age	-0.268755	0.427464	-0.629	0.5295
‘ ‘	Older	-0.817416	0.511782	-1.597	0.1102
Concentration	Middle age	-0.20796	0.30243	-0.688	0.49168
‘	Older	0.02124	0.34243	0.062	0.95055
Market orientation	Middle age	-0.37358	0.42852	-0.872	0.383317
‘ ‘	Older	0.12398	0.48226	0.257	0.797115
Livestock orientation	Middle age	0.92329	0.744418	1.241	0.21472
	Older	0.32521	0.76179	0.427	0.66944
Diversification of production	Middle age	-0.846965	0.345103	-2.454	**0.014118****
‘	Older	-0..302836	0.373681	-0.810	0.417703
Diversification through jobs & remittances	Middle age	-0.39037	0.49015	-0.796	0.425787
‘ ‘	Older	-0.61886	0.63593	-0.973	0.330473
Diversification through exploitation	Middle age	-0.675319	0.454971	-1.484	0.1377
	Older	-0.4063	1.0871	-0.374	**0.0223***

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

A strong difference was found with regard to diversification of production. Thus, compared to older household heads and young household heads, the middle-aged group of household heads opted significantly more often for this response in times of crisis. The probability that farming will be diversified becomes significantly higher among middle-aged farmers. Diversified households grow a variety of crops and rear livestock species such as small ruminants (goats and sheep), as well as chickens, turkeys and guinea fowls, as a way of optimizing their income-earning capacity through the diverse intensification of crops and livestock. The analysis also confirmed a strong difference with regard to diversification through exploitation. Thus, compared to young and middle-aged household heads, the older household heads opted significantly more for this response in times of crisis. With regard to all other types of response, no statistically significant correlation was found.

4.3.2.2 Gender

General situation

Gender in rural areas is important in determining who makes farm-management decisions and how they respond to crises. Although as heads of households, men still dominate much of the decision-making process, farmers reported making joint decisions with their wives, while *de facto* female-headed households with either absent or none at all were now more involved in farm-management decisions than they used to be before. While absent husbands were reported as influencing farming decisions from afar, *de facto* female heads of households with absent husbands said they sometimes made farming decisions themselves and only informed their husbands later. They reported making the decisions they saw fit regarding what to grow, how much to grow and where, and how to allocate the available resources accordingly. Besides farm-management decisions, male heads were previously targeted more by extension services and providers of farm inputs than female farmers, who would be left out, despite rural households being largely dominated by female heads, who contribute immensely to agricultural production. Since a female extension office has been set up, female-headed households are now targeted by extension services and input providers. Also, due to the patriarchal nature of society, the land traditionally belongs to men. However, the majority of de-facto female-headed households without husbands either inherited their land from their late husbands, or had plots of land parceled out to them to grow their crops. In the case study located in the 'resettlement area', they applied for land and were allocated farms in their own names. Although the number of women allocated land in the redistribution program is low, the fact that they were even considered for allocation was a step towards equality in resource ownership, especially of land. In the case study located in 'small-scale farms', there were also some female-headed households consisting of widows who were continuing to use the land after the deaths of their husbands.

In fact, nearly half of the surveyed households (44.29%) were female-headed, 25.48% being de facto female-headed with an absent husband and 18.81% without any living husband. About 55.71% of households were male-headed. Such '**male-headed'** farmers were evenly distributed across the two case studies located in communal areas in 'intact and impoverished landscapes', but many more were male-headed in two case studies located in 'small-scale farms and 'resettlement') than female-headed. In the latter case studies, more male heads owned land than their female counterparts. In these households, farm management decisions were still heavily managed by men, and although they were reported to be consulting their wives, the final decision was made by them. Not only did they make decisions on farm management, they also decided how to spend money raised from both on-farm and non-farm activities. They were still being targeted with extension and input services, though the recruitment of female extension agents saw previously disadvantaged women being equally targeted by these services.

De facto female heads of households with absent husbands reported that they often consult their husbands on farm-management decisions, but more than a third of this category said they made certain decisions themselves, especially in urgent matters, and informed their husbands later. Some of these women are left to make all the decisions regarding farm management, which gives them the flexibility to adopt strategies that are mostly pursued by male farmers, such as market orientation and livestock production, especially of cattle. Small livestock have traditionally been regarded as a female concern, but in response to crises female-headed households began to increase these herds, as these animals are resistant to drought, but most importantly they are easier to convert into cash than cattle. Economically, female-headed households with small livestock reported to be self-sufficient, as they use chicken and goat manure to fertilize their vegetable gardens, one of their main sources of income. Female-headed households make contacts with extension agents much more than they used to. With an absent husband it is paramount for the remaining wives to have contacts with extension services to obtain the necessary information and advice needed to improve and increase productivity. However, female-headed households tend to have increased workloads additional to their usual household chores, as they cover what their husbands would otherwise do if they were around. In thesehouseholds, if they lack the capacity to hire labor, child labor is inevitable.

The farmers in ***de facto female-headed households without a living husband*** are independent in taking farm-management decisions, as they do not have a husband or other male figure to consult before making their decisions. The only challenge most of these households have is that they have few or none of the assets needed to pursue agricultural production, being restricted by having to depend on relatives or community members for support. For example, they are among the poorest households among the surveyed households and as such are largely constrained in properly managing their land. However, they have contacts with extension agents in their own capacity as farm-owners, and following the introduction of female extension agents, they reported having more such contacts than before. The situation in households with regard to gender was strongly correlated with some of the other farm, personal and institutional features analyzed (Table 27).

Table 27. Spearman correlation coefficients between gender and the other analyzed features with the p-values for them

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Gender	**0.02***	-0.08	-0.10	0.08	1.00	**0.01***	-0.01	**0.01***	**0.04***	-0.12	-0.10	**0.02***

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

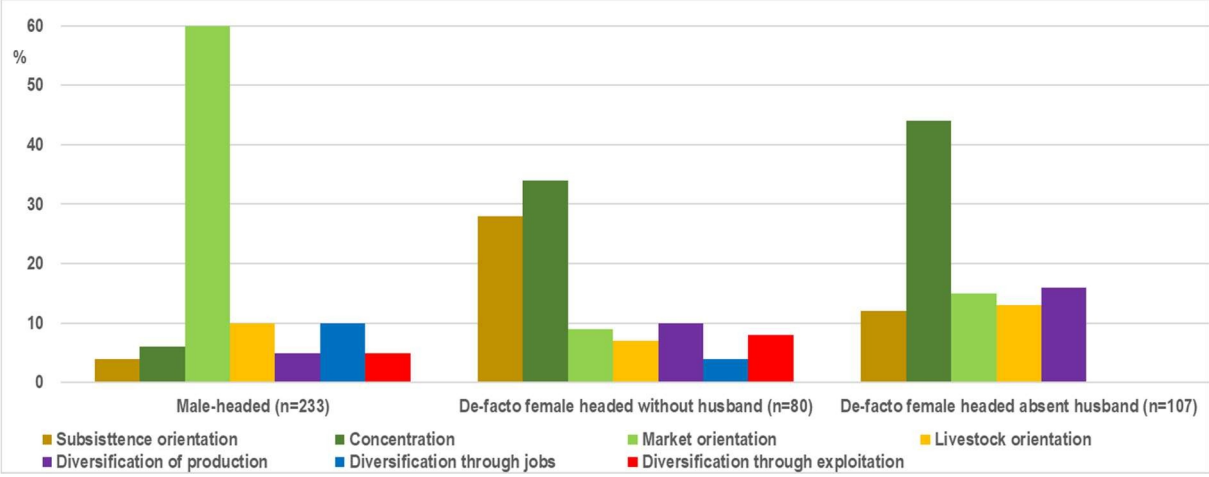
Most significantly, gender was positively correlated with the level of education of the household head and farming experience. For example, the more educated and experienced the household head the more successful were the chosen strategies. Another strong correlation existed between gender and farm assets. Thus, having farm assets was more likely in male-headed households, even in the case of absent husbands, compared to female-headed households. In this patriarchal society, rural men often prioritize the accumulation of assets to demonstrate their wealth, while for women small livestock have historically been considered livestock for female farmers. Although this tradition is still alive, during the Zimbabwean crisis small livestock have been thriving under the harsh climatic conditions, making those women who own them financially stable, as they can more easily be converted into cash than cattle. Also, a strong correlation is shown between gender and social organization. Thus, the participation of the household in associations or other organized groups was more probable among female-headed households, although in the case study located in 'small-scale farms', the probability of male farmers belonging to the dairy association was high because the majority of the households were headed by male heads. Lastly, the probability of gender increased with financial situation. For example, rich households were numerous among male-headed households, particularly in the two case studies located in 'small-scale farms and resettlement area'. There were, however, no significant correlations with the other features.

Responses

Households belonging to the three gender-related categories (male heads, female heads with absent husbands and female heads with no living husband) showed strongly different response patterns (Figure 21).

The households that were male-headed showed a wide range of responses to crises. Most frequently, such households oriented themselves towards markets, while other strategies were less frequent, and played nearly no role at all. In contrast, concentration, diversification of production, market orientation and livestock production were the most frequent responses of *de facto* female-headed households with absent husbands. None of the households in this category started to exploit resources, but some of them switched to subsistence farming. Accordingly, households in the category of de facto female-headed households without husbands showed a mixture of these two patterns, with the most frequent response being concentration and a re-orientation towards subsistence farming. These households nonetheless showed all type of responses: other than concentration and subsistence orientation, however, these are less accentuated.

Figure 21. Proportion of farmers' responses to crises by gender categories



During crises, **male-headed** households managed not only to invest in production for their own consumption, many of them started to produce cash and food crops intensively for markets. Particularly those farmers who oriented themselves towards markets through the production of milk and tobacco reported a significant increase in incomes through milk and tobacco sales. Thus, despite the manifold challenges, these households were able to grab the opportunity to produce for the market and still earn money, which they used support their farming business and family. In terms of farm-management decisions, the majority of males in this category reported making decisions jointly with their wives, indicating improvement in the social status of farming women. The other households who opted for the other strategies had the least frequency, and for them these responses played almost no role at all.

In contrast, ***de facto* female-headed households with absent husbands** had support from the latter, which enabled them to concentrate and diversify their production. Most importantly, these households were able to produce not only enough for their families but also a surplus, which was sold to raise additional income. As they become the sole managers of their farms in the absence of their husbands, these households reported accessing extension services more than they used to do. Apart from having contacts with extension agents, women farmers stated that they often make decisions and inform their husbands later, or sometimes consult them to begin with. According to them, this is slowly becoming a practice in that they can freely decide what needs to be done on the farm without experiencing any problems with their absent husbands. If anything, female farmers reported receiving much support from absent husbands in terms of capital from remittances, not only to invest in the farm, but also as capital with which to venture into other non-farm activities. For the case study located in 'intact landscape', this also provided money for membership of internal savings and lending clubs. This indicates that women's active participation in this organized savings group money is made possible through remittances, while other members of such groups raised their contribution from thesale of farm produce. They also lacked the means to invest in diversification, which further increased the risk of food shortages in a bad season. Particularly those farmers who oriented themselves towards subsistence farming had low yields. The majority of these farmers produced only what they eat, which was often not enough to see them through to the next farming season. Therefore, many of these farmers started to exploit resources outside their farms, such as wood collection, brick-making, the streambank cultivation of vegetable gardens and the illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in impoverished and intact landscapes. In the other two case studies this strategy was not so much an option of choice because the majority of such households have assets, except for a very few poor households, who turned to exploitation out of desperation. However, the exploitation strategy seldom generated enough income to cover the households' needs, so that farmers without assets often had to look for low-paid jobs. However, the low wages were also insufficient to equip the

farm with the necessary assets, and in addition this off-farm employment dramatically reduced the available workforce.

Moreover, most of the households in the ***de facto* female-headed households without husbands** were rather poorly equipped. They were only able to produce moderate amounts of the inexpensive manure needed for effective concentration of production. Accordingly, they most frequently reverted to subsistence farming or sought for opportunities to exploit resources outside their farms. However, contrary to households without assets, at least a quarter of them managed to diversify their production enough to grow a variety of food crops, though without achieving the productivity of well-equipped farmers.

Statistical significance of the found differences

A probit regression on the influence of gender on households' responses in times of crisis revealed some statistically significant relations, particularly with regard to subsistence orientation, market orientation, diversification of production and exploitation (Table 28).

Table 28. Probit regression of gender and responses

Response	Gender category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Absent husb.	-0.002548	0.264592	-0.010	0.9923
' '	Male-head	0.610718	0.272795	2.239	**0.0252***
Concentration	Absent husb.	-0.02050	0.18039	-0.114	0.90954
'	Male-head	-0.26655	0.19169	-1.391	0.16436
Market orientation	Absent husb.	-0.48002	0.26944	-1.782	**0.074823.**
' '	Male-head	-0.52063	0.29669	-1.755	**0.079299.**
Livestock orientation	Absent husb.	0.14439	0.46465	0.311	0.75599
' '	Male-head	0.75008	0.61943	1.211	0.22593
Diversification of production	Absent husb.	1.682731	0.215439	7.811	**5.69e-15*** **
' '	Male-head	0.969062	0.234950	4.125	**3.71e-05*** **
Diversification through jobs & remittances	Absent husb.	10.13304	349.93223	0.029	0.976899
' '	Male-head	0.47942	0.33875	1.415	0.156997
Diversification through exploitation	Absent husb.	0.009391	0.311371	0.030	0.9759
' '	Male-head	0.631243	0.297576	2.121	**0.0339***

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found with regard to the diversification of production. Thus, compared to households headed by women without husbands, male-headed households and *de facto* female-headed households with absent husbands opted significantly more often for this response in times of crisis. The probability of diversification of production is significantly higher in households with absent husbands. Another strong difference was found with regard to subsistence orientation. Thus, compared to de facto female-headed households with absent husbands, as well as those without any husbands, the probability of pursuing subsistence farming decreases with the rise in the number of male-headed households. Also, the calculations indicated that diversification through exploitation is most probable among male-headed households. Right on the margin of statistical significance is market orientation, more probable in male-headed households and those with absent husbands, and more often opting for this response in times of crisis. With regard to all other response types, no statistically significant correlation was found.

4.3.2.3 Education

General information

The level of education of the household head determines his or her ability to access and understand information relating to farming and markets. The highly educated will thus be able to calculate the costs and benefits of alternative responses. In the context of all four case studies, the more highly educated farmers demonstrated a better understanding of agricultural production methods and made

greater contributions to decision-making at the household and community levels. They also understand the importance of engaging with extension services for the benefit of acquiring the much-needed information regarding production and livestock management. Thus, farmers consider education to be most important, particularly in order to understand the jargon used by extension agents. Access to information is perceived as crucial by farmers, as this strongly influences their decisions to adopt sustainable responses, which not only increase productivity but also help them realize some income and achieve product surpluses. In contrast, those who are less educated often use mental shortcuts involving experiment or trial and error, exploratory problem-solving techniques which utilize self-educating techniques to cope with crises. The use of shortcuts, however, does not guarantee optimal, perfect or even rational solutions, but can be sufficient for achieving immediate, short-term goals, such as having the basics for survival, no matter what damage may be caused by their responses to crises.

In general, the **highly educated** had tendency to specialize in high returns in on-farm and non-farm activities with a strong connection to markets. Thus, their level of education enables them to access information not only through extension services, as they often take the extra step to find online information about products on demand and market information. Just over a third (35.24%) were highly educated, with a majority specializing in milk and/or tobacco production as their main sources of income. Such '**highly educated'** farmers were found mostly in two case studies ('small-scale farms and 'resettlement'), very few being found in communal areas located in 'intact and impoverished landscapes.' In the 'small-scale farm' and 'resettlement area' case studies, there were more farmers who had acquired higher qualifications, including a farming certificate or even a degree in agriculture. In the context of communal areas located in 'intact and impoverished landscapes' former extension agents now lead other farmers in organized farmer groups. Thus, the highly educated make greater contributions, have a greater willingness to participate and contribute to decision-making regarding rural development programs, their knowledge having an impact on others. They also positively contribute to community farming decisions, such as starting irrigation projects in the case study located in 'intact landscape'.

By contrast, the ***less educated*** reported to be struggling to cope effectively with the Zimbabwean crisis. They engaged the least with extension services, and even when they did, they reported finding the agricultural jargon too complex for them to understand and often did not seek clarity for fear of embarrassing themselves in front of others. Consequently, they failed to increase productivity and in turn are stuck with relying on low-return, non-farm activities, such as the exploitation of natural resources or finding jobs on other farms. The little income they earn ensure that their children, like their parents, will not receive much education but instead are likely to drop out of school early and engage in all sorts of low-return activities as a family strategy for survival. Even when they try to diversify, they often chose a lower level of diversification of sources of income or crop production. Therefore, the lack of education acts as a barrier to many such households in this category, hindering them from engaging in high-return activities, and thus keeping them trapped in structural poverty. This speaks to the relevance of education, particularly where creativity and innovation play a critical role in effectively coping with crises.

The farmers in the ***medium-educated category*** also had insufficient capacity to cope effectively with crises. For example, they concentrated their production but with insufficient access to extension services were not able to improve productivity significantly. Such households were also largely constrained in engaging properly with markets due to their limited information about markets and farming. However, these farmers often managed to use the little knowledge they had to diversify their production, particularly those who belonged to an organized farmer group, where they obtain information and learn skills from lead farmers. Although there is also a tendency in this category to use heuristics to make farming decisions, farmers stated their openness to receiving and implementingnew technologies with information provided by lead farmers and extension agents, thus demonstrating the creativity and innovation required to cope effectively with crises. The situation in

households with regard to education was strongly correlated with some of the other farm, personal, and institutional features analyzed (Table 29).

Table 29. Spearman correlation coefficients between education and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Educ.	0.77	0.17	**0.01***	0.00	**0.01***	1.00	-0.77	0.00	0.72	**0.03***	0.07	**0.05***

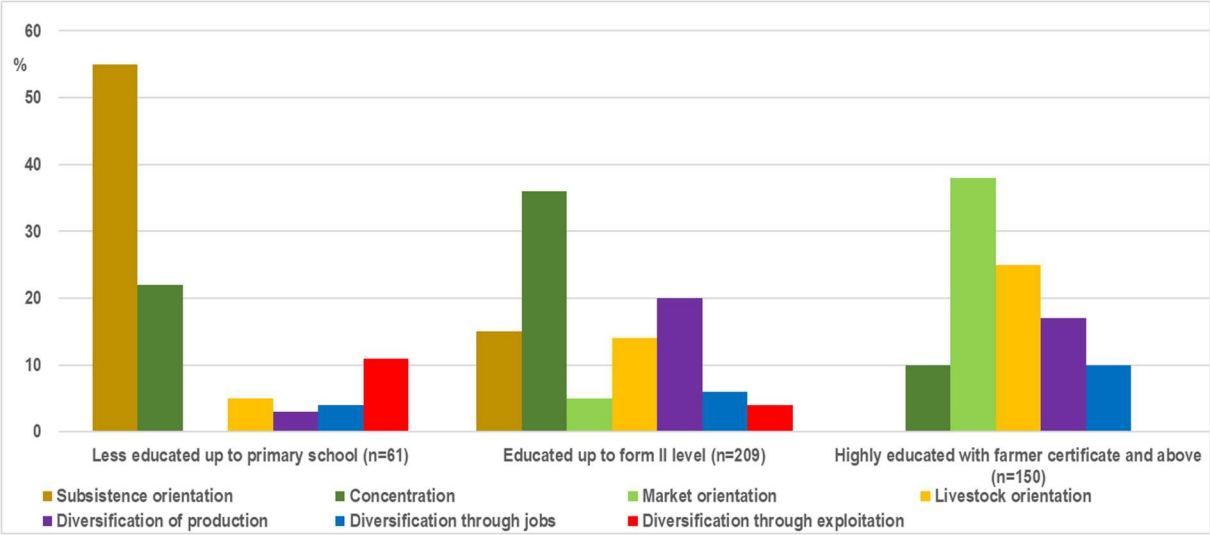
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, remoteness was positively correlated with the level of education of the household. For example, household heads located near urban centers were more educated than those remotely located. Also, once the parents have been educated, their children too will receive an education, given the value placed on education in order to have a better life. Another strong correlation was found between education and gender. Thus, being highly educated was more likely for male-headed households, and although girls are now being given an equal opportunity to learn, the majority of older women were only educated up to Form II, and others only up to primary level. This restriction on getting women educated was historically meant to keep them in subordinate positions as 'housewives' without involvement in decision-making. This tradition is still practiced but rather on a lesser scale among poor households. However, women reported that the establishment of various women's organizations with empowerment and gender programs has led to women slowly being recognized as equal farming business partners who actively contribute towards farm management and community farming decisions. Also, the probability of having access to extension services is increased for those with a higher education. For example, highly educated farmers frequently seek extension advice in solving problems rather than using shortcuts or trial and error as methods. The probability of being part of an organized group is also increased with higher education. The highly educated understand the importance of coming together to discuss problems and collectively finding solutions, and that the best platform with which do so is through organized groups.

Responses

Households belonging to the three education categories showed strongly different response patterns (Figure 22).

Figure 22. Proportion of farmers' responses to crises by education categories



The households that were highly educated showed a wide range of responses to crises. Most frequently, such households oriented themselves towards markets, livestock and the diversification of production, while other strategies were less frequent. None of the households in this category started to exploit resources or switched to subsistence farming. In contrast, re-orientation towards subsistence, concentration and diversification through exploitation were by far the most frequent

responses of the less educated households. None of the households in this category engaged with markets. For them, other responses played nearly no role. Accordingly, households in the category of educated up to Form II level showed a mixture of these two patterns. They showed all types of responses, though they were less accentuated.

The **highly educated** households during the crises managed to not only invest in production for their own consumption, many of them even started to produce cash and food crops intensively for the market. Particularly those farmers who oriented themselves towards markets through the production of milk and tobacco reported significant increases of income compared to before. Thus, despite economic hardships and liquidity challenges, they regularly produced marketable products which they sold to raise income. These households also had the means to raise livestock fundamental to raising cash, but most importantly as source of manure needed to fertilize their crops, thus optimally using the available resources with the benefit of increased area productivity. Thus, concentration and diversification of production nearly always went along with market orientation. As a consequence, highly educated farmers were well connected to relevant platforms and networks (e.g., milk collection centers, tobacco auction floors, GMB, millers and supermarkets), even increasing their competitive market advantage. These farmers reported that most of the money raised from market participation was used beside investments on farms in order to acquire more knowledge through further education programs and to educate their children. Accordingly, the majority of the educated farmers had greater opportunities to find highly remunerated jobs in urban centers or abroad. Some farmers in this category also reported to be receiving remittances from educated members who migrated as another way of diversifying their sources of income. This indicates that the highly educated often have a chance to find well paid jobs as they have greater flexibility in living better lives while supporting their farming initiatives by means of the remaining family members on the farm.

In contrast, the **less educated households** had fewer options to respond constructively to crisis situations. Most critical was their inability to make decisions guaranteeing optimal, perfect or rational choices, but rather opted for strategies that enabled them to realize an immediate and short-term goal for purposes of survival. By re-orienting themselves towards subsistence farming, such households had low yields and further increased the risk of food shortages in a bad season. The majority of these farmers produced only what they ate, which was often not enough to see them through to the next farming season. Therefore, many of these farmers started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and the illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in 'impoverished' and 'intact landscapes.' In the other two case studies this strategy was not so much an option because the majority of farmers were highly educated and chose high-return farm and non-farm activities. The exploitation strategy rarely made enough income to cover the households' needs, so that the less educated farmers often had to look for low-paid jobs. Nonetheless, their low wages were insufficient to meet all the household's requirements, while in addition this non-farm employment dramatically reduced the number of children going to school, thus trapping both the current and future generations in structural poverty.

Moreover, most of the households in the **educated up to Form II category** were rather moderately educated. They were able to concentrate their production using inexpensive manure by integrating crop-livestock production and the diversification of production. Accordingly, they engaged moderately with markets, while most frequently reverting to subsistence farming or searching for opportunities to exploit resources outside their farms. However, contrary to the less educated households, about a fifth of them managed to diversify their production to include a variety of food crops, though without achieving the productivity of the highly educated farmers.

Statistical significance of the found differences

A probit regression on the influence of education on the household's responses in times of crisis revealed some statistically significant relations, particularly with regard to subsistence orientation and diversification through jobs and remittances (Table 30).

A strong difference was found with regard to subsistence orientation. Thus, compared to the highly educated households, particularly the households educated up to Form II level, the less educated households opted significantly more often for this response in times of crisis. The probability of increasing subsistence orientation was found to fall with increasing education. Thus, higher education is correlated with less subsistence orientation. The calculations indicated that subsistence orientation is a strategy principally followed by the less educated households. The analysis also confirmed the capacity of highly educated household heads to diversify effectively through jobs and remittances. Thus, the probability of highly educated household heads finding a high-return job is higher than for farmers in the other two categories. With regard to all other response types, no statistically significant correlation was found.

Table 30. Probit regression of education and responses

Response	Education category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Medium	-0.833593	0.370776	-2.248	**0.0246***
‘ ‘	Highly	-0.617482	0.678723	-0.910	0.3629
Concentration	Medium	0.14013	0.28370	0.494	0.62135
‘	Highly	0.10734	0.49448	0.217	0.82815
Market orientation	Medium	-0.24664	0.42625	-0.579	0.562851
‘ ‘	Highly	-0.37652	0.71799	-0.524	0.599996
Livestock orientation	Medium	-5.02269	527.28132	-0.010	0.99240
‘ ‘	Highly	-4.31100	257.28298	-0.008	0.99348
Diversification of production	Medium	-0.051715	0.368906	-0.140	0.888514
‘ ‘	Highly	0.193206	0.670399	0.288	0.773197
Diversification through jobs & remittances	Medium	0.24021	0.62812	0.382	0.702141
‘ ‘	Highly	2.54274	1.10056	2.310	**0.0020866***
Diversification through exploitation	Medium	-0.651800	0.406308	-1.604	0.1087
‘ ‘	Highly	-0.909858	0.814182	-1.118	0.2638

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

4.3.2.4 Family size

General information

Family size, according to farmers, is an important indicator of production through family labor. The size of the family also influences the choice of activities a household can undertake. For example, large families with many adults can allocate responsibilities for on-farm and non-farm activities simultaneously, whereas small families with two or three adults often find it difficult to allocate sufficient labor for a variety of activities, especially on large farms and where work is predominantly manual. In contrast to large families, even on small parcels of land for case studies located in 'intact and impoverished landscapes', small families still find it more difficult to engage in diverse non-farm activities to earn an income than large families. When it comes to working in on-farm activities, large households with more labor were able to adopt numerous farm-management practices in response to changing climatic conditions. For example, large families with more labor available often spent short periods of time preparing land for planting, whether with draught power or manually digging planting basins, than small families. For small families, this is the most difficult activity, one that commences as early as the beginning of August and may last several months, but large families may take only days or weeks to do the job, depending on the farm size. Thus, the less the available labor the household has, the more difficult it is for it to diversify and increase its productivity. However, small wealthy households compensate for this lack of labor by hiring seasonal labor as a supplement. Although large families may also suffer reduced labor when their children become adults, marry and leave, for those

who decide to continue living and working on their parents' farm, this may considerably increase the available labor force with additional new family members.

In general, **large families** are able to allocate labor to members to work in the fields or herd cattle, while others do non-farm activities to earn incomes. More than half of households (54%) had more adults living and working together. This gives the household the capacity to choose activities that provide them with profits while saving the costs of hired labor, as this can easily be provided from within the family. Such large families were found among the less educated in the case studies located mostly in 'intact and impoverished landscapes.' Some large households used not their own children, but extended family members living and working on the farm. Although extended families have been eroded in recent years, there are still farm households with orphans from their late children who died from HIV and AIDs and who have come to live with their grandparents. This often leads to considerable changes in household size and available labor.

In contrast, ***small families*** reported being constrained in increasing their productivity because they depended on their own labor, and hired labor was not easy to find due to their economic hardships and lack of cash. In the event that they successfully hired seasonal or year-round labor, they reported much of their income going towards paying wages, thereby negating their efforts to realize an income. Some households without adequate labor often benefited from communal collaboration (*nhimbe* or *mushandirapamwe*), in which members come together to assist each other in tasks such as tilling, planting, weeding, harvesting and threshing small grains. However, such communal collaboration is only practiced in the case studies located in 'intact and impoverished landscape'. Thus, small families in the other two case studies are forced to outsource labor for a fee. Poor small families who cannot afford to hire labor are often stuck with relying on low-return activities and are therefore trapped in structural poverty. The situation in households with regard to family size was not correlated with any of the other farm, personal or institutional features analyzed (Table 31).

Table 31. Spearman correlation coefficients between family size and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Family size	-0.60	-0.15	-0.01	0.00	-0.01	-0.77	1.00	-0.01	-0.63	0.00	-0.07	-0.08

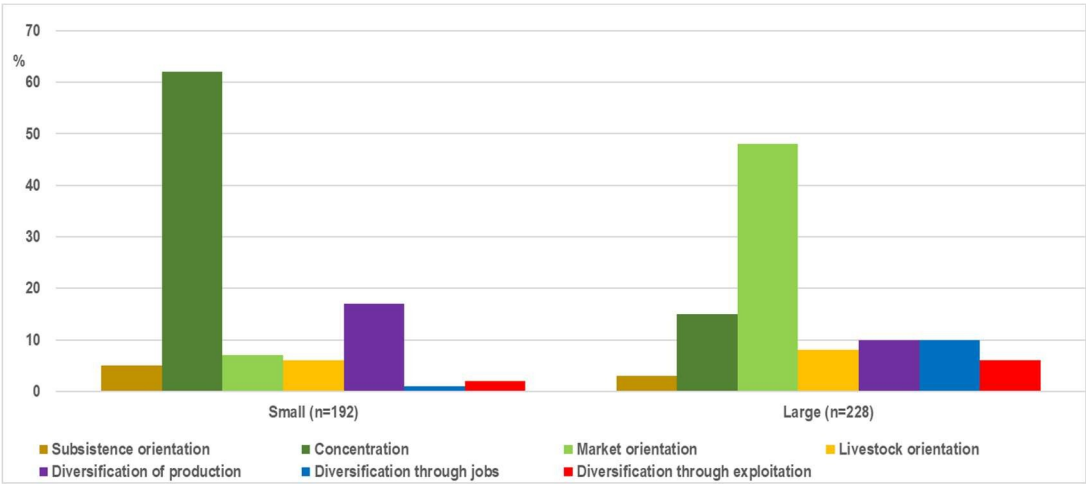
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Family size was found not to have any statistical correlation with the other features.

Responses

Households belonging to the three family size categories showed strongly different response patterns (Figure 23).

Figure 23. Proportion of farmers' responses to crises by family size categories



Large families showed a wide range of responses to crises. Most frequently, such households oriented themselves towards markets, while the other strategies were less frequent. An insignificant number of households switched to subsistence farming. In contrast, concentrated and diversified production were by far the most frequent responses of small families. For both large and small families, the other responses were less accentuated.

During crises the ***large family*** households managed not only to invest in production for their own consumption, many of them even started to produce cash and food crops intensively for the market. Here, the available labor played a critical role, especially among tobacco farmers, as tobacco farming is labor-intensive, more labor being required to effectively improve the quality and quantity of the produce. Even for those who re-oriented themselves towards milk production, although milk cows are left to browse freely in allocated grazing areas within the farms, milking which is done manually twice a day, requiring more labor, particularly in households with large numbers of milk cattle. These dairy farmers were only found in the case study located in 'small-scale farms.' Farmers located in the 'resettlement area' also milked their cows, but on a very low scale that did not warrant them engaging with markets. Instead, they sold their milk locally. Large families could also allocate responsibilities among available adult members, as some combined both milk and tobacco production, both of which are labor intensive. These were mostly farmers located in the case study 'small-scale farms.' The majority of them almost managed to produce with their own labor but occasionally hired outside labor in exceptional cases. In the communal areas in case studies located in 'intact and impoverished landscape', large families reported to be combining more than three strategies and could allocate its members proportionally to the requirements of the chosen strategies. In this case, other members would work on the farm producing both food and cash crops, as well as raising livestock rearing, while others could be assigned to exploitative activities (especially in poor large families), with one or two sending members away to earn money by working in urban areas or abroad.

In contrast, ***small families*** had fewer options to engage effectively with markets due to limited labor availability and the high costs of hiring it in difficult times such as these. However, most small families managed to concentrate their production effectively on the most suitable land. This worked well for small families with less labor, as the concentration process involved the utilization of small pieces of land using sustainable farming practices aimed at producing higher returns. This strategy, adopted by small families, was mostly used by farmers in marginal dry areas of communal regions in case studies located in 'intact and impoverished landscapes', a practice that reduced the demand for labor, while still increasing area productivity from lower investments, and hence realizing higher profit margins. The concentration process allows farmers in this category to concentrate resources (inputs and labor) on a small plot of land to facilitate optimum management resulting in increased productivity. For optimum benefits, farmers reported starting to prepare the land early by digging planting basins before the start of the season and acquiring all the necessary inputs in advance. For these households, preparing land early, which they do off-season, allows them to plant their crop with the first effective rains. For others, concentration took the form of irrigation projects, which helped supplement rainwater in a dry spell. The other small families prepared small pieces of land for concentration near water sources like rivers to allow supplementary watering of their crops. In both cases, efficiency in using water was practiced by farmers mulching their fields with either grass or crop residue as a way to conserve moisture. Intercropped maize and legumes also provided soil cover for fixing nitrogen into the soil. The majority of these farmers had two plots, one for cereals (maize or small grains) and one for legumes, thus providing a source of protein to complement the cereals. Such farmers were able to diversify their production and had more food available, thereby increasing the food security of their households. The few who could not effectively concentrate their production re-oriented themselves towards subsistence farming, but these were mostly poor small families who lacked the assets required to increase productivity.

Statistical significance of the found differences

A probit regression on the influence of family size on the household's responses in times of crises revealed no statistically significant relations with the adopted responses (Table 32).

Table 32. Probit regression of family size and responses

Response	Family size category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Large	0.037541	0.335589	0.112	0.9109
Concentration	Large	0.03226	0.24603	0.131	0.89568
Market orientation	Large	-0.46015	0.35604	-1.292	0.196217
Livestock orientation	Large	0.84652	0.72379	1.170	0.242177
Diversification of production	Large	-0.314517	0.301841	-1.042	0.297414
Diversification through jobs & remittances	Large	0.20725	0.80082	0.259	0.7958
Diversification through exploitation	Large	-0.062366	0.389881	-0.160	0.8729

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

4.3.2.5 Farm experience

General information

Experience of farming was important in influencing decisions and the management of farming business. Based on experience, farmers are able to make decisions on what to grow, e.g. whether to grow food only for the family or for both the family and the market. According to farmers, such decisions may also hinge on the history of past investments in their land, as well as the risks involved and how to overcome them. For example, the majority of experienced farmers stopped producing maize as a cash crop following a fall in the price for maize, which is determined and controlled by the government through its parastatal, the Grain Marketing Board. Farmers recall how they raised an income from maize production before the Zimbabwean crisis and how maize production has now become a high risk, as the producer price does not match their investments for its production.

In general, experience with farming helps farmers improve productivity and to make the most out of their land while protecting their environment. Farmers with **more experience** have expertise in growing the most appropriate and profitable crops depending on the agro-ecological region in which they are located. For those located in marginal and vulnerable situations in communal areas located in 'intact and impoverished landscapes', maize production is not the most appropriate crop. However, experienced farmers have switched to concentrating their production on the most suitable land, that is, smaller plots of land, accompanied by the adoption of sustainable technologies in order to increase productivity. Most of them work on two or three small plots on which they also grow small grains, which are more resilient to drought and hard climatic conditions. In difficult times and to supplement much needed dietary protein, experienced farmers either intercrop maize with legumes or have a separate plot on which to grow legumes for the family. If they combine food with cash crops, experienced farmers also decide on the most appropriate and profitable cash crops. In this case, tobacco was the fastest selling and most rewarding commodity. Some of these farmers also switch to niche crops like potatoes, as well as a variety of vegetables which they can sell to supermarkets. They have expertise not only in what types of crops to grow, but also on the types of livestock to rear. In particular, experienced farmers located in 'small-scale farmers' rear milk cows and reported this to be more successful in raising much needed income, as they are paid fortnightly from the daily deliveries, they make to the Milk Collection Centre. In the case of experienced farmers in case studies located in the 'intact and impoverished landscape', the switch to small livestock that are drought-resistant provides much needed cash and manure, as does the empowerment of women financially, as small livestock is regarded as 'women's livestock'. According to farmers, small livestock can be converted into cash more easily than cattle.

The less experienced, however, reported that they were constrained in increasing productivity because they had only limited knowledge. For this reason, the majority of the less experienced farmers re-

oriented themselves towards subsistence farming. They also reported struggling with the changes in climatic conditions and rainfall variability which they said makes planning more difficult. Some of them recorded a complete crop failure in the 2016/17 drought, though the more experienced farmers replanted in January and realized a bumper harvest. For the less experienced, they had suffered from the risk seeing their crops wilt under intense heat, which lasted for more than two months, making them scared to risk replanting when the rains finally came at the end of January 2017. Due to their lack of experience, they often choose inappropriate crops seeds like long-maturing varieties when the more experienced farmers opted for short-maturing varieties. Such mistakes are costly, as the rains will end before the crops have fully matured, resulting in a decrease in yields. Farmers with less experience often have few assets and are therefore constrained in diversifying their production due to the limited amounts of manure they have to improve soil fertility and thus increase productivity. This lack also influences the less experienced farmers not to adopt new technologies fully: for example, they dig planting basins but do not use organic manure or mulching, both of which are very important in increasing yields. The situation of households with regard to farming experience was strongly correlated with some of the other farm, personal and institutional features analyzed (Table 33).

Table 33. Spearman correlation coefficients between farm experience and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Farm expnce.	-0.01	**0.01***	-0.06	0.65	**0.01***	0.00	-0.01	1.00	-0.10	-0.01	-0.07	-0.02

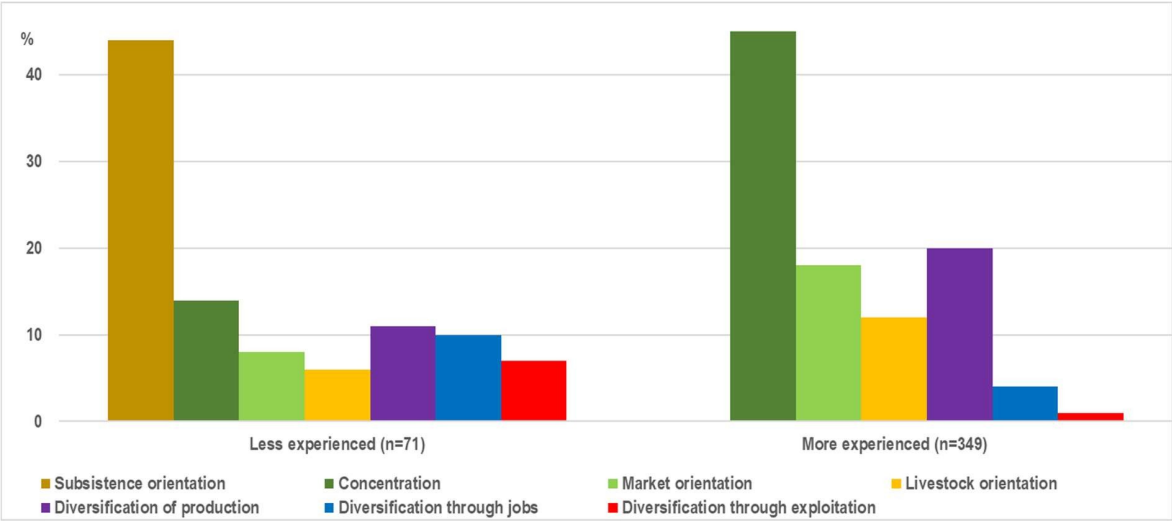
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, farming experience was positively correlated with farm size. For example, large farm owners have long histories of living and working on their farms. For this reason, they have expertise in growing and raising the most appropriate and profitable crops and livestock. Another strong correlation was found between farming experience and gender. Thus, having more farm experience was more likely in households headed by men, particularly those who consider farming to be a business and who have lived and worked on their farms for many years. The Spearman correlation coefficient calculation did not find any correlations for the other features analyzed in relation to farming experience.

Responses

Households belonging to the three farm-experience categories showed strongly different response patterns (Figure 24).

Figure 24. Proportion of farmers' responses to crises by farming experience categories



The more experienced households showed a wide range of responses to crises. Most frequently, such households concentrated, diversified their production or oriented themselves towards markets, other strategies being less frequent. None of the households in this category switched to subsistence farming. In contrast, re-orientation towards subsistence was by far the most frequent response of the less experienced farmers. They showed all the other type of responses, though these were less accentuated.

The ***more experienced*** households were better adapted to the changing conditions through knowledge they had previously acquired, which they used to make informed choices while avoiding risks. Using past experience, these farmers were able to cope effectively with crises by choosing strategies that ensured the maximization of profits from smaller plots of land from which productivity was increased through concentration and intensification. To be able to cope effectively with crises, these farmers adopted sustainable technologies to improve soil- and water-management practices compared to what they did before. These farmers demonstrated initiative in trying out new technologies and acknowledging that the changes in weather patterns meant that keeping to business as usual would result in crop losses. Experienced farmers had a different perception of climatic conditions and rainfall variability, as well as histories of how they had overcome, for example, total crop failure during a drought. Given such experience, they reported a significant increase in productivity per hectare compared to before. Given a long history of the management of both crops and livestock, they reported regularly producing more, including surpluses which they sold to earn an income.

In contrast, ***less experienced*** households had less knowledge and skills with which to respond constructively to crisis situations. Most critical was their inability to produce a surplus to enable them to engage actively with markets. The few households that engaged with markets were out growers supported by private companies who were still learning a lot, their produce being lower in quantity and quality compared to that of the more experienced farmers. They also had little experience and lacked the means to invest in diversification, further increasing the risk of food shortages in a bad season. In particular, those farmers who oriented themselves towards subsistence farming had low yields. Most of them produced only what they ate, which was often not enough to see them through to the next farming season. Therefore, many of these farmers started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in impoverished and intact landscapes. The exploitation strategy rarely generated enough income to cover the household's needs, so that the farmers with less experience often had to look for low-paid jobs. However, the low wages proved insufficient to meet their household requirements and needs, and in addition this off-farm employment dramatically reduced the available workforce.

Statistical significance of the found differences

A probit regression on the influence of farm experience on the household's responses in times of crises revealed no statistically significant relations to adopted strategies (Table 34).

Table 34. Probit regression of farm experience and responses

Response	Level of experience	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	More	-0.020051	0.467352	-0.043	0.9658
Concentration	More	0.0.19820	0.32953	0.601	0.54754
Market orientation	More	0.46713	0.47453	0.984	0.324918
Livestock orientation	More	-1.28835	0.82619	-1.559	0.11891
Diversification of production	More	0.606406	0.387021	1.567	0.117149
Diversification through jobs & remittances	More	0.21196	0.59645	0.355	0.722316
Diversification through exploitation	More	0.377900	0.501500	0.754	0.4511

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Probit regression revealed no statistically significant correlations between farming experience and the various strategies adopted by farmers in response to crises.

4.3.2.6 Financial situation

General situation

The financial situations of rural farmers are important, as they need money for a variety of purposes, such as farm inputs, school fees, medicines, transport and many other household requirements. Farmers with money are powerful members of their communities, often dominating decision-making processes at both the household and community levels. In dominating community decision-making, the rich tend to stifle the poor, who often have no say in community decisions because of their social status. The poorer farmers suffer the most in crisis situations, as dominant powerful actors also occupy empty spaces at times, even encroaching on to the land of the poor, which often results in conflicts that the poor do not always win.

In general, a household's financial situation is one of the major determinants for improved or decreased levels of production. The '**rich'** farmers were found mostly in two case studies located in 'small-scale farms and 'resettlement'. In the 'small-scale farm' case study, farmers had lots of cattle which could be converted into cash, but some of them had become rich through the income generated from highly paid employment or farming. Also, the few rich households found in communal areas located in 'intact and impoverished landscapes' had accumulated their wealth either from previous employment in which they had accumulated the capital to grow their rural wealth in the form of farm assets, or from farming. The rich farmers tended to expand their production to include cash crops as a source of income, while others continued with milk production. Using such strategies, the rich farmers avoided the consequences of the Zimbabwean crisis almost entirely, as they successfully chose the most appropriate and profitable crops and livestock. Also, the fewer rich farmers in the other two case studies were mostly retired civil servants, war veterans, local leaders and successful farmers. Rich farmers in all case-study areas regularly invested in growing their asset base from the money raised from the sale of tobacco, maize or milk, or from remittances. The more farm assets a household has, the wealthier it is, this defining the financial situation of that household. The rich farmers mostly took advantage of the opportunities provided by the situation of crisis by actively engaging with markets in order to make profits at a low cost or to invest more in livestock as a buffer against economic and climatic shocks. Farmers reported that for them both large and small livestock are forms of 'rural wealth' that can be sold and converted into cash in times of crisis. Rich farmers also engaged not only in high-return farm activities, but also in non-farm activities with the aim of realizing maximum profits from few resources. Rich families also reported family members living abroad who regularly sent remittances to support the remaining family members. Such remittances helped to offset income shocks and helped recipient households to plan effectively and choose the most appropriate and profitable options.

In contrast, ***poor households*** reported that they were constrained in increasing productivity because they did not have the money to buy inputs. Households lacking finance often benefited from seed distributions by NGOs, and occasionally from the government input scheme, but more regularly from the seed bank facility in the case of farmers located in 'intact and impoverished landscape'. A seed bank facility was established in these communities especially for poor farmers who cannot afford farm inputs. The seeds are stored either at the village heads' premises or by lead farmers. These leaders reported that when faced with hunger poor households often eat the seed, making it difficult for them to plant at the same time as others when effective rains arrive. The poor households are often confined to low-income, labor-intensive activities, such as working as farm laborers and exploiting natural resources, which keeps them trapped in structural poverty. The financial situations of households were strongly correlated with some of the other farm, personal, and institutional features analyzed (Table 35).

Table 35. Spearman correlation coefficients between financial situation and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Financ. situation	0.58	0.18	**0.07**	-0.07	**0.04***	0.72	-0.63	-0.10	1.00	**0.04***	0.13	0.17

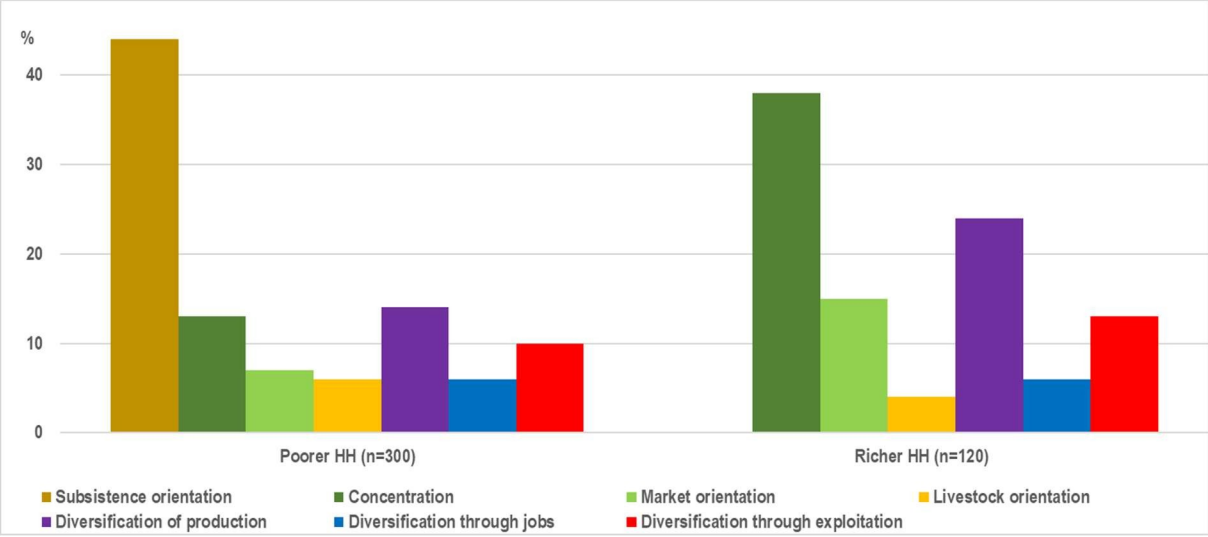
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, the financial situations of households were positively correlated with remoteness. For example, the nearer a household is to main markets the more likely it is to be better off financially. Another strong correlation existed between financial situation and extension services. Thus, rich households with cars were more likely to receive reasonable extension services, as they could pick up and drop off the extension agent at own expense. Lastly, financial situations could be linked with gender. For example, working husbands with high-paid jobs, particularly those located in the case studies that are nearer to markets, i.e., 'small-scale farms and resettlement area', were more likely to have a better life, with money to finance their farming operations. There was no statistical significance regarding the other features.

Responses

Household belonging to the two financial situation categories showed strongly different response patterns (Figure 25).

Figure 25. Proportion of farmers' responses to crises by financial situation categories



The **rich** households showed a wide range of responses to crises. Most frequently, such households concentrated or diversified their production, while other strategies were less frequent. None of the households switched to subsistence farming. In contrast, re-orientation towards subsistence was by far the most frequent response for poor farmers. The other responses, however, were less accentuated. Rich households who managed to retain money and assets during crises managed not only to invest in production for their own consumption, many of them even started to produce cash and food crops intensively for markets. In particular, those farmers who concentrated their production reported a significant increase in productivity per hectare compared to before. Thus, despite having smaller areas under cultivation, they regularly produced a surplus, which they sold to raise an income. These households also had the money to buy inputs. Thus, more than a quarter of these farmers were able to buy fertilizers to complement animal manure, and this had a multiplier effect, as their production significantly increased. In sum, this made the rich households more successful with the concentration strategy compared to the poor households. In the same vein, the availability of money also positively influenced the possibility of farmers making the necessary investments to diversify production, thereby responding to emerging market opportunities, for example, when the prices for

vegetables were high. Thus, concentration and diversification of production nearly always got along with market orientation. As a consequence, the rich farmers were well connected to relevant platforms and networks (e.g., milk collection point, tobacco auction floors, millers, the GMB), which enhanced their competitive market advantage still further. These farmers reported that most of the money raised from participation in the market was re-invested in improving their land and in growing their rural wealth in the form of assets. Some rich farmers also reported receiving remittances from household members who migrated to urban centers or abroad This indicates that the rich are often highly educated, giving them a chance to find well-remunerated jobs and this enjoying greater flexibility in living a better life while accumulating the much-needed capital to finance both on- and off-farm activities.

In contrast, poor **farmers** had fewer options in constructively responding to crisis situations. Most critical was their inability to buy the inputs needed to guarantee productivity on poorer soils even when concentrating their scarce resources. They also did not have the means to invest in diversification, which further increased the risk of food shortages in a bad season. In particular, those farmers who oriented themselves towards subsistence farming had low yields. Most of them produced only what they ate, which was often not enough to see them through to the next farming season. Therefore, many of these farmers started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and the illegal mining of gold deposits along the river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in "impoverished and intact landscapes". In the other two case studies this strategy was not so much of an option because the majority of farmers were already rich, except for a very few poor households who turned to exploitation out of desperation. The exploitation strategy rarely generated enough income to cover the households' needs, so that the poorer farmers often had to look for low-paid jobs. However, the low wages were also insufficient to equip the farm with the money it required, and in addition this off-farm employment dramatically reduced the available workforce.

Statistical significance of the found differences

A probit regression on the influence of a household's financial situation on its responses in times of crisis revealed some statistically significant relations, particularly with regard to market orientation and diversification of production (Table 36).

Table 36. Probit regression of financial situation and responses

Response	Financial situation category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Rich	-7.545e-01	5.151e-01	-0.010	0.9919
Concentration	Rich	-0.40981	0.39451	-1.039	0.298905
Market orientation	Rich	-1.15994	0.68995	1.681	**0.000799*** **
Livestock orientation	Rich	-0.71973	0.90882	-0.792	0.428
Diversification of production	Rich	0.99841	0.47159	2.117	**0.034251***
Diversification through jobs & remittances	Rich	-1.22090	0.65537	-1.863	0.0625.
Diversification through exploitation	Rich	-5.5750	580.1461	-0.010	0.9923

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found with regard to market orientation. Thus, compared to poor households, rich households especially opted significantly more often for this response in times of crisis. The probability of market orientation become significantly higher with increasingly rich households. The analysis also confirmed the capacity of rich households to diversify their production effectively. With regard to all other response types, no statistically significant correlation was found.

4.3.3 Institutions

4.3.3.1 Extension services

General situation

Extension services are important in providing much needed information enabling farmers to plan effectively and make good choices, especially in the face of changing weather conditions and rainfall patterns. They urgently require information on climate change and climate variability, as well as markets and livestock rearing, but with weak extension services, the majority of farmers are inadequately served by extension, advice and research services. This lack of information impairs farmers' well-being and happiness and makes decisions more difficult regarding what to plant, when to do so and how much. For poor farmers, this is a double tragedy, as they not only lack information, but also have limited resources and access to markets, which in turn restricts their adoption of new technologies and consequently their exclusion from markets. Extension services were reported to be minimal to non-existent for households located further from markets compared to those located near to them. The lack of vital information hampers farmers' ability to make assessments of alternative options or even to calculate the costs and benefits of preferred choices. Critical to receiving information is farmer's ability to use it to diversify their production portfolios to earn an income and increase production. Without information, some farmers start to depend on selling their labor, but if they are not able to sustain their subsistence needs, they are forced to engage in exploitative activities.

In general, rural farmers, particularly those in the small-scale sector, are inadequately served by research, advisory and research services. This lack of information makes decision-making difficult for most farmers. More than half (59.05%) reported accessing reasonable extension services, while 40.95% received minimum services. Farmers who often receive '**reasonable'** extension services were mostly found in case studies located nearer to markets ('small-scale farms and 'resettlement'), as well as near business centers and roads for case studies located further from markets. The latter were mostly found in communal-area case studies located in 'intact and impoverished landscapes.' In the four case studies, there were three extension agents for each, but in three of the case studies located in 'small-scale farm, intact and impoverished landscapes' the extension team comprised two females and one male. This opened up an opportunity for the previously neglected group of women farmers also to be targeted more than they had been before. Farmers reported the challenge of a lack of transport for extension agents to provide on-farm advice. The rich with cars would therefore regularly pick up and drop off the agents, which the poorer farmers could not do. Given reasonable access to extension services and information, farmers were able to engage in diverse high-return, on-farm and off-farm activities, which enabled them to increase the household's food security and incomes.

In contrast, farmers who receive ***minimum*** extension services reported that they were constrained in increasing productivity, as they found it extremely difficult to plan what to plant, when to do so and how much. This has impaired the well-being and happiness of a majority of households with minimum access to extension services, as they re-oriented themselves towards subsistence farming with very low yields. The majority of farmers who are inadequately served by extension services were found in the two case studies located in 'resettlement area and intact landscapes.' Mostly, farmers located in the mountains, with no easy access, received only the very minimum of services. Some three villages in both case studies reported not having any services at all. This deprives them of much needed information to inform their decisions and choices in the face of changing conditions, particularly given unpredictable rainfall and extreme climatic conditions. Consequently, these households reported being food insecure and more often than most had to rely on food handouts from humanitarian organizations, the government (food for work program) or well-wishers. These households in these two case studies are thus trapped in a vicious cycle of poverty, the continued lack of information pushing them even deeper into poverty. The crisis situation has continued for a very long time, during which these households have been struggling to survive and to produce for their families. Hence, they end up engaging in exploitative strategies for survival. The situation of households with regard to extension services was strongly correlated with some of the other farm, personal and institutional features analyzed (Table 37).

Table 37. Spearman correlation coefficients between extension services and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Extens. Services	**0.02***	0.09	0.76	-0.12	-0.12	**0.03***	0.00	-0.01	**0.04***	1.00	0.57	0.41

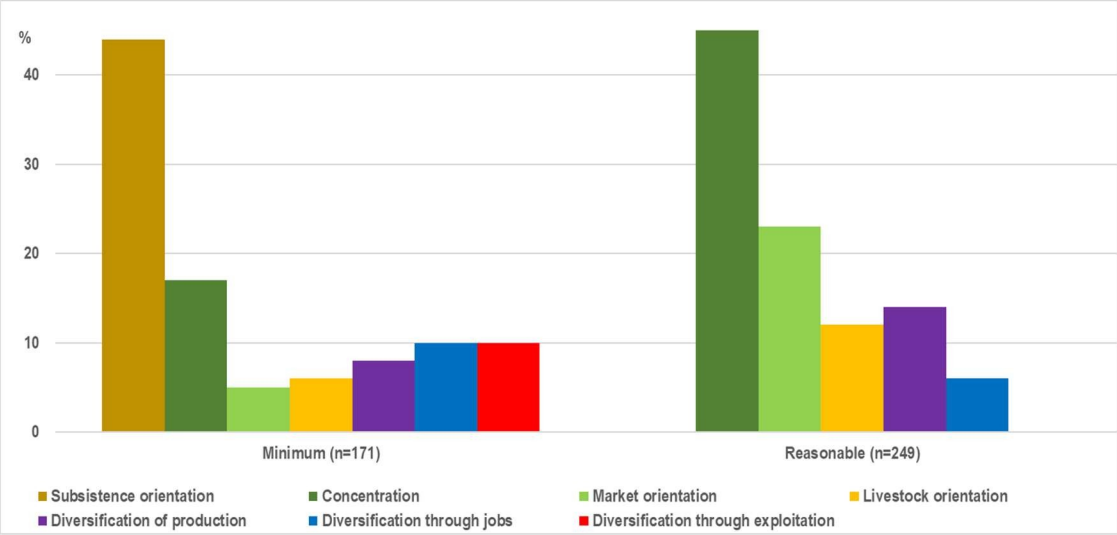
Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

Most significantly, ownership of farm assets was positively correlated with reasonable access to extension services. For example, farmers with cars could provide transport to extension agents to come to their farms and take them back again. Another strong correlation existed between extensionservices and education. Thus, being highly educated was more likely to lead one to engage with extension agents, as the educated seek more information enabling them to make informed decisions and choices. Lastly, the probability of rich households accessing extension services was greater than for poor households. For example, rich households dominate not only community decision-making, but also the institutions that work with communities. Thus, the probability of rich households accessingextension services increases with the power and dominance they have in their community.

Responses

Households belonging to the two extension categories showed strongly different response patterns (Figure 26).

Figure 26. Proportion of farmers' responses to crises by extension service intensity categories



Households with minimum access to extension services showed a wide range of responses to crises. Most frequently, such households re-oriented themselves towards subsistence farming and concentration, while other strategies were less frequent. In contrast, concentration, market orientation, diversification of production and livestock orientation were by far the most frequent responses of those farmers with reasonable access to extension services. None of the households in this category started to exploit resources or switched to subsistence farming. For them, other responses played a minimum role.

Households with **reasonable** access to extension services during crises managed not only to invest in production for their own consumption, but many of them even started to produce cash and food crops intensively for markets. In particular, those farmers who concentrated their production reported a significant increase in productivity per hectare compared to before concentration. Thus, despite only have smaller areas under cultivation, they regularly produced a surplus, which they sold to raise income. These households also had extension information that was crucial to their choosing the production system that offered the highest returns, and this had a significant multiplier effect. In sum,

this made households with reasonable access to extension services more successful with their concentration strategies compared to households with minimum access. In the same vein, the availability of information also positively influenced the ability of farmers to produce for the market and also to diversify production, thereby responding to emerging market opportunities, for example, when prices for vegetables rose. Thus, the concentration and diversification of production nearly always went along with market orientation. As a consequence, farmers with reasonable access to extension services were well connected with relevant platforms and networks (e.g., milk collection points, tobacco auction floors, the GMB, millers etc.), which in turn even enhanced their competitive market advantage. Some farmers in this category reported trying out new technologies based on information received from extension services.

In contrast, farmers with **minimum access** to extension services had fewer options to respond constructively to crisis situations. Most critical was their inability to increase production due to a lack of information and other essential assets like manure and mulching material to guarantee the productivity on of poor soils, even when concentrating their scarce resources. They also had no information on how to invest effectively in diversification, further increasing the risk of food shortages in a bad season. Particularly those farmers who oriented themselves towards subsistence farming had low yields. The majority of these farmers produced only what they ate, often not enough to see them through to the next farming season. Therefore, many of these farmers started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and the illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in 'impoverished and intact landscapes.' In the other two case studies this strategy was not so much of an option because the majority of farmers had reasonable access to extension information, except for a very few with minimum access who turned to exploitation out of desperation. The exploitation strategy seldom generated enough income to cover a household's needs, meaning that farmers with minimum access to extension services often had to look for low-paid jobs. However, their low wages also proved insufficient to meet their household food requirements, and in addition this off-farm employment dramatically reduced the available workforce.

Statistical significance of the found differences

A probit regression on the influence of the available extension services on the household's responses in times of crisis revealed some statistically significant relations, particularly with regard to market orientation (Table 38).

Table 38. Probit regression of extension services and responses

Response	Extension services category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Reasonable	2.348e-03	4.223e-01	0.589	0.5557
Concentration	Reasonable	-0.16167	0.25059	-0.645	0.51882
Market orientation	Reasonable	-1.94720	0.94343	-2.064	**0.039021***
Livestock orientation	Reasonable	0.18505	0.81710	0.226	0.82083
Diversification of production	Reasonable	0.373309	0.322216	1.159	0.516951
Diversification through jobs & remittances	Reasonable	0.47414	0.61044	0.777	0.246632
Diversification through exploitation	Reasonable	0.075983	0.368297	0.206	0.8365

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

A strong difference was found with regard to market orientation. Thus, compared to households with minimum access to extension services, households with reasonable access to such services opted significantly more often for this response in times of crisis. The probability of market orientation is significantly higher with increasing access to extension services. With regard to all the other response types, no statistically significant correlation was found.

4.3.3.2 Financial support

General situation

Financial support is needed most importantly for the acquisition of agricultural inputs, as well as to buy the necessary farm assets vital for crop production. Farmers also listed irrigation materials, supportfor the adoption of new technologies and training as important areas for which they would require financial support. Due partly to the inadequacy of the financial resources allocated to small-scale farmers and the misappropriation of funds and equipment earmarked for agriculture, farmers have for a very long time not been supported, which negatively affects their ability to cope effectively with a crisis. This was further compounded by the decline of the economy, which forced banks either to reduce or stop issuing loans. Where loans were made available, poor farmers reported that the interest rates (16-40%) they charged were too high for them to repay after harvesting, thus discouraging them from taking out bank loans. With the government and local banks not able to support farmers, the latter were left alone with the challenge of sustaining their livelihoods and guaranteeing food for their families under highly unfavorable conditions. Nevertheless, farmers had to come up with ways of coping with crises. Against this backdrop, numerous local and international NGOs and private companies came in with manifold initiatives to support farmers in some way, thus covering the gap created by the failures of governments and local banks to support rural farmers. For example, in two of the case studies located in 'intact and impoverished landscapes', Misereor played an important role is supporting the establishment of irrigation project and the promotion of conservation farming and animal husbandry. The latter involved the distribution of small livestock to selected households, which in turn were expected to pass the young goat or chicken to the next household until all the households in a group had some livestock. Other support came from other international NGOs, particularly in the case study located in 'intact landscape,' where World Vision, Caritas Denmark, the European Union and local community-based organizations funded a total of six other irrigation projects and fifteen nutrition gardens with boreholes and pumps. In addition to Misereor' support, farmers in the case study located in 'impoverished landscape' were aided by the Mashonaland Tobacco Company, which provided inputs, extension services and markets for the cultivation of tobacco. Farmers reported that the support they receive from government plays almost no role, as it is only provided once every five years when there are elections. The Mashonaland Tobacco Company is also actively supporting farmers in two other case studies located in 'small-scale farms and resettlement area'. While the latter only receive support from this private company, the other case study has received support from STABEX. Lands O Lakes International provides technical and financial support to dairy farming, including the establishment of a revolving fund from which farmers can borrow to increase their stock of milk cows. In addition, a local white commercial farmer, Aldington, provides support with vaccines, topped up the cattle bank fund, provides refresher courses and shares management with the Milk Collection Centre. Occasionally, the government provides farmer with inputs, but farmers complained that this support, when it is available to them, often provides too few inputs (four farmers must share a 50 kg bag of fertilizer), and the inputs are often distributed late.

In general, support to small-scale farmers is lacking. Unlike large- and medium-scale commercial farmers, who are highly capitalized, small-scale farmers are excluded from the support the other two sectors are given. More than half of the surveyed households (62.38%) had no support, while a little more than a third (37.62%) had support as outlined above. Farmers '**with support'** were found in all the four case studies, but they varied considerably in terms of volume, duration of support and the number of local organizations and NGOs active in the different case studies. The case study located in the 'resettlement area' was the least served by financial support, as only the Mashonaland Tobacco Company was active there, and there were no donors and local NGOs operating in the area. In the 'small-scale farm' case study, farmers received support for dairy production and tobacco farming. Supported farmers were able to grow the number of their milk cows, which in turn increased daily milk deliveries and consequently the income for these households. With regard to tobacco farming, farmers signed contracts in which they agreed to return a certain quantity of tobacco bales to the Mashonaland Tobacco Company as repayment for the inputs and other accompanying services they receive. Surplus bales are what they make profit from, and with stable prices farmers reported making profits

particularly in a good season. The same contractual arrangements were made with farmers in the other two case studies located in 'resettlement area and impoverished landscape', except for the latter, who reported that they were not provided with transport due to the long distances and that this ate into their small profit margins, as transport is very expensive. In the case study located in 'intact landscape', support was provided in the form of fencing materials, pipes and tapes for irrigation projects. Farmers also received seeds and fertilizers in the first year, after which they would be responsible for their own inputs. For those who received support for conservation farming, they were given seeds mostly in the shape of small-grain varieties, early-maturing open pollinated varieties of maize and fertilizers for a period of three years, after which they are weaned off these provisions, and new households are registered for support. The same households also received small livestock in the form of goats and chickens enabling them to produce the vitally needed manure for the concentration process. This category also received remittances from family members who had migrated elsewhere. This source of income was critical to those not supported by the other sources of finance mentioned above.

Households ***without financial support*** reported that they were heavily constrained in increasing productivity because they lacked the support others households were receiving. These households reported struggling to make ends meet. For this reason, the majority of them simply re-oriented themselves towards subsistence farming with very low yields. The majority of farmers without support were found in the communal case studies located in the 'resettlement area', followed by case study located in 'impoverished landscape and intact landscape'. Poor households without support found it difficult to effectively cope with crises and were largely constrained in properly managing their land. The situation of households with regard to financial support was strongly correlated with some of the other farm, personal and institutional features analyzed (Table 39).

Table 39. Spearman correlation coefficients between financial support and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Financ. support	**0.05***	0.21	0.60	-0.12	-0.10	**0.07**	-0.07	-0.07	0.13	0.57	1.00	0.72

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

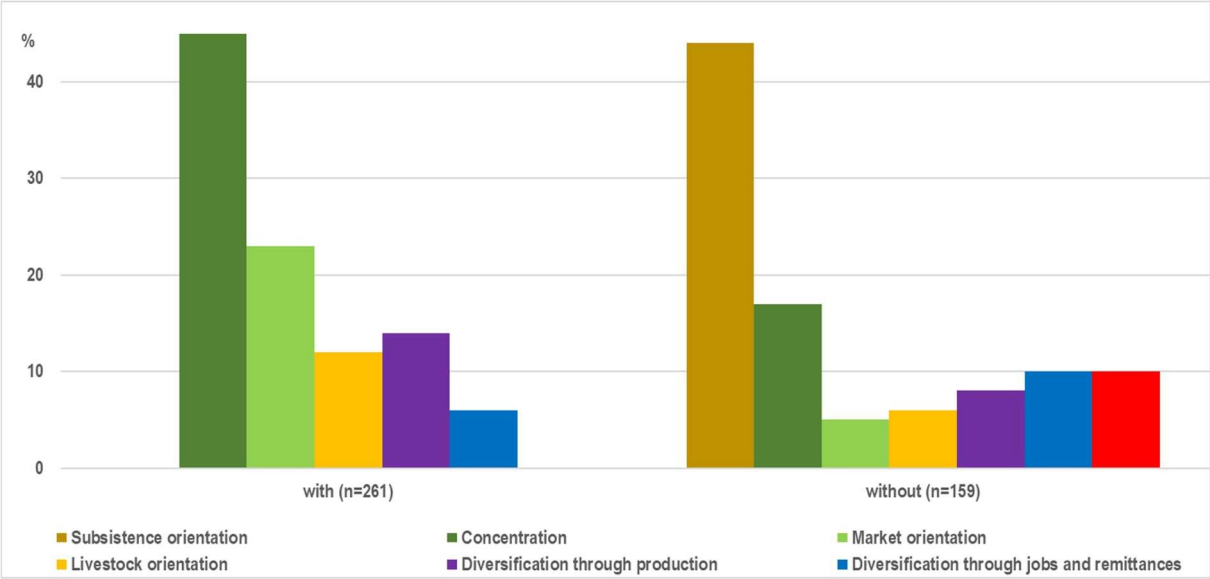
Most significantly, financial support was positively correlated with farm assets. For example, farmers with support (milk producers, irrigators, small livestock producers, tobacco farmers) were more likely to have more assets than they had before, when they had no support. This was true for households in the case studies located in 'small-scale farms', which had access to a revolving fund, and the communal area located in 'intact landscape', where there was NGO support to livestock production. Another correlation was found between financial support and education. Although this correlation approached the borderline of significance, having had a higher education also increased access to financial support. No significance was found for the other features.

Responses

Household belonging to the two financial support categories showed strongly different response patterns (Figure 27).

The households that were supported financially by NGOs and private contract organizations showed a wide range of responses to crises. Most frequently, such households concentrated, oriented themselves towards markets or diversified their production, while other strategies were less frequent. None of the households in this category started to exploit resources or switched to subsistence farming. In contrast, re-orientation towards subsistence and concentration were by far the most frequent responses of those farmers without support. The other responses were, however, less accentuated.

Figure 27. Proportion of farmers' responses to crises by financial support categories



The households **with financial support** during crises managed not only to invest in production for their own consumption, many of them even started to produce cash and food crops intensively for the market. In particular, those farmers who concentrated their production (71.67%) reported significant increases in productivity per hectare compared to before. Thus, despite the smaller areas under cultivation, they regularly produced a surplus, which they sold to raise an income. These households had also the means to raise livestock (84.29%) as a vital source of the manure needed to fertilize their crops, which had a significant multiplier effect. Livestock producers could easily convert them into cash when the need arose. Those who oriented themselves towards markets through the production of milk or tobacco (26.43%) were well connected with the relevant platforms and networks (e.g. tobacco auction floors, milk collection points, the GMB, millers etc.), which in turn even enhanced their competitive market advantage. In sum, this allowed the supported households to be more successful with their concentration strategies, market orientation or diversified production compared to households without. In the same vein, the availability of support also positively influenced the ability of farmers to make the necessary investments to diversify production, thereby responding to emerging market opportunities, for example, when the prices of vegetables rose. Thus, the concentration and diversification of production nearly always went along with market orientation. These farmers reported that most of the money raised from market participation was re-invested in the land, especially by growing their asset base, which they also use as a fallback mechanism, where some assets may be sold in difficult times, for example, in a drought year, and restocked once the situation improves.

In contrast, **farmers without financial support** had fewer options to respond constructively to crisis situations. Most critical was their inability to concentrate their scarce resources effectively in order to increase their productivity on poor soils. They also lacked the means to invest in diversification, which further increased the risk of food shortages in a bad season. Those farmers who oriented themselves towards subsistence farming in particular had low yields. The majority of these farmers produced only what they ate, often not enough to see them through to the next farming season. Therefore, many of them started to exploit resources outside their farms, such as wood collection, brick-making, streambank cultivation of vegetable gardens and the illegal mining of gold deposits along river banks to generate some supplementary income. Such strategies were mostly confined to the two communal case studies located in 'impoverished and intact landscapes.' In the other two case studies this strategy was not so much of an option because the majority of farmers were supported or wealthier, except for very few poor households which turned to exploitation out of desperation. The exploitation strategy seldom generated enough income to cover a household's needs, so that the farmers without

assets often had to look for low-paid jobs. However, the low wages were also insufficient to meet their household needs, let alone to equip the farm with the required assets.

Statistical significance of the found differences

A probit regression on the influence of financial support on households' responses in times of crisis revealed some statistically significant relations, particularly with regard to concentration, market orientation and diversification of production (Table 40).

Table 40. Probit regression of financial support and responses

Response	Fin. Support category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	With	-6.113230	343.292456	-0.018	0.9858
Concentration	With	-1.75154	0.33397	-5.245	**1.57e-07*** **
Market orientation	With	3.27121	0.52499	6.231	**4.63e-10*** **
Livestock orientation	With	-0.04511	0.81232	-0.056	0.95571
Diversification of production	With	-1.806541	0.448945	-4.024	**5.72e-05*** **
Diversification through jobs & remittances	With	-6.27802	349.93098	-0.018	0.985686
Diversification through exploitation	With	-5.311629	362.750804	-0.015	0.9883

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

The strongest difference was found with regard to concentration. Thus, compared to households without financial support, households with support opted significantly more often for this response in times of crisis. The probability of concentration is significantly higher with increasing access to financial support. Another strong difference was found with regard to market orientation: the analysis confirmed the capacity of funded households for effective market orientation. Finally, another strong difference was found with regard to diversification of production: compared to households without financial support, those with support opted significantly for this response in times of crisis. With regard to all other response types, no statistically significant correlation was found.

4.3.3.3 Social organization

General situation

Social organization is important for rural farmers, as it provides some form of organization to present their interests, as well as being a forum for collective action. Coming together helps communities, particularly those located in communal areas 'intact and impoverished landscapes', to decide collectively how to improve food security in the face of increasingly extreme weather conditions. According to farmers, this is especially important where individuals cannot tackle the problem alone: when they collectively decide on community farming projects, such as an irrigation project, conversely, they come together and plan how to do it and by when. Also, given weak extension services, communities also benefit from coming together and forming farmers' groups led by highly knowledgeable people with a farmer's certificate or retired extension agents. Others wanting to engage actively with markets through milk production found efficiency in working in organized groups rather than individually, especially where quantities are low. Working in groups is especially important not only to present members' interests, but in learning from each other, for example, reducing transaction costs when they organize transport collectively rather than individually. In difficult times, farmers therefore found it more beneficial to work with others than to work individually. Even to establish their own savings and lending schemes, they had to come together and agree how they would do it, often resulting in the drawing up of constitutions.

In general, social organization has helped members increase productivity, incomes and livestock. However, more than half of the surveyed households (68%) were not part of any organized group, unlike the other third (32%). Such 'organized' farmers were found mostly in three case studies ('small-scale farms', community in intact and impoverished landscapes'). In the 'small-scale farm' case study, farmers were organized in a dairy association with 46 registered members, 38 of them active. In the

‘community in intact landscape’ case study, farmers were organized into irrigation, farmers’ and nutrition garden groups, and internal savings and lending clubs. In contrast, farmers in the ‘impoverished landscape’ case study were organized around farmers’ groups and one irrigationgarden. Details of these groups are provided below. However, in the case study ‘resettlement area’, farmers were not organized into groups, but all worked individually.

Irrigation groups

In total there were seven irrigation groups, of which six were found in the case study of a ‘community in intact landscape’ and one in the ‘community in the impoverished landscape’ case study, established with the support of donors and local NGOs. Irrigation group members mobilized each other in response to a decline in production due to aridity, erratic rainfall and poor sandy soils, as the only way out for these communities was to resort to collective action to stem the decline in production, which in turn resulted in food insecurity. The numbers in each group varied according to the size of the irrigation, with the smallest group, found in the ‘impoverished landscape’ case study, having 54 members. Being part of these organized irrigation schemes influenced group members to reduce, concentrate and intensify their production in irrigation projects, resulting in shifting cultivation with long fallow periods on household fields by shifting their main production to irrigated areas. Compared to farmers in the two other case studies, ‘small-scale farms and resettlement areas’, farmers worked individually, but they too had irrigation facilities, mostly for horticultural produce like vegetables, while others had home gardens situated close to their homesteads, with boreholes and pumps to irrigate their crops.

Farmers’ groups

Farmers’ groups were found in the two case studies located in ‘in intact and impoverished landscapes.’ Of a sample size of 240 households, more than half (55%) were part of organized farmer groups. There were twelve groups in each case study, with ten members in each group led by a lead farmer. Of these lead farmers, about 27% had a farmer’s certificate, while 6% were former AGRITEX officers. Given the minimum extension support, lead farmers play a critical role in disseminating information and transferring knowledge to their group members. Household members in farmers’ groups were all induced to reduce, concentrate and intensify production on their most suitable land. A process which combining sustainable agro-ecological practices such as conservation farming with farmers’ groups is often held up as a role model for the knowledge they possess and the knowledge of best practice they exhibit on their land. Given the climatic conditions, especially the dry and erratic rainfall, as well as poor sandy soils in the area, additional work to maintain soil fertility is important. A total of 62% of households had invested in soil conservation work on their fields in the past ten years. Farmers’ groups are important, as farmers continuously learn and share experiences, but most importantly they also can combine their surplus produce, negotiate a better price for large quantities and later share the income they have earned based on each individual’s share of the produce.

Nutrition garden groups

These are comparatively speaking smaller groups than the irrigation groups, with between ten and fifteen members organized around nutrition gardens. Nutrition gardens were established with support from various local and international NGOs. They were only found in one case study located in ‘intact landscape’. Some nutrition gardens are equipped with boreholes and submersible pumps, while those near rivers use pedal pumps to draw water to irrigate their crops. Being part of an organized group had a strong influence on members orienting themselves towards producing a variety of vegetables for the local market. Members grow and sell tomatoes, onions, kale, cabbages, carrots, peas and manyother vegetables, which are sold to local people, schools, hospitals, at church gatherings and to local traders. Across nutrition garden groups, about a third of members are involved in trading mostly vegetables, which members reported as one of their sources of income. As a result, a local economy isincreasingly developing, as members combine several other sources of income depending on what they have that they can sell in addition to vegetables. As such, common sources of income for nutritiongarden groups include selling goat’s milk (13%), goats (15%) and poultry (32%). Such diversification ofsources of income among group members has resulted in increases in food security, nutrition and

earnings by households, although the majority of members' main incomes come from maize, with a third of group members' incomes being earned by selling vegetables. It can be seen that the average figures tend to hide the differences in income earnings among group members, as they sell individually not collectively, though of course a significant number within these groups reported struggling to make ends meet. However, of the members who are doing well, some made strategic investments in water management using money raised from vegetable sales in order to establish home gardens as a way of expanding their vegetable enterprise, and they help each other develop their business enterprises. Such investments are increasing the production of vegetables significantly among group members, who see selling vegetables as a business.

Internal Savings and Lending Clubs

As a mechanism to save money at the very local level, some household members started ISALCs, mostly in irrigation and nutrition gardens. 21 Internal Savings and Lending Club groups (ISALCs) were found in the case study located in 'intact landscape', while one such group was found in the case study located in 'impoverished landscape'. These groups collected savings from group members which were then used to extend loans to group members. The loans were issued against one's savings, surrendered to the club as collateral, but generally not exceeding the savings the debtor has accumulated with the club. Being part of an organized ISALC group had a strong influence on group members in further diversifying their earnings as part of a portfolio, given the situation that a significant number, perhaps a quarter of members, have limited or no assets and produce less because of the variability of crop production. Diversifying one's sources of income is essential.

These savings clubs are a self-funding micro-finance model, unlike the revolving fund in small-scale farms, which is externally funded. The savings clubs mostly consist of between ten and fifteen members, so in some irrigation groups, there may be more ISALC groups, while smaller irrigation groups, for example Dembweni with 28 members and Kamutserendende with 25, incorporated all their members into a single ISALC group. ISALC group members agree to meet once a month to save small amounts of money ($5-10), which is more often generated through the sale of farm produce. The majority of members in these clubs are women (82%), and the rest are men. Interview data showed that each club developed its own constitution that guides them in how to control the money. The constitution is signed by all ISALC group members and later signed by their village heads, ward councilor and the police in order to guard against members defaulting. Complementing the survey results were findings from experts who cited transparency, trust, commitment and frequency of contribution as the reasons for the success, growth and sustainability of ISALCs groups. The majority of successful ISALC groups are found among the community in intact landscape compared to the one and only ISALC for the community in the impoverished landscape, which declined significantly in numbers from 54 to twelve active members, as many of its members were reported to have defaulted, despite the group having a constitution.

Surveyed household members in ISALCs showed that, once members had saved enough money, they started lending themselves at an agreed rate of interest. Group members who had benefited from borrowing from an ISALCs reported having strengthened their livelihood projects, which included broiler and small livestock production, flea markets, retail shops and grinding mills. Consequently, about 30% of group members established businesses which contributed to household incomes. It was found that the majority of ISALCs were for women. The survey showed that women significantly improved their household incomes and economic activities, increased household expenditure on essential social services, were able to access to cash assets and disposable income, access to business capital for rural micro-enterprise activities and a general improvement in household resilience to external shocks, such as liquidity shortages and food insecurity. Diversifying income portfolios through organized ISALC groups is essential given the economic situation in Zimbabwe, as is informal self-help to group members at the local community level. This in a way decreases the dependence of households on government subsidies for inputs, and/or their reliance on unavailable bank loans, as well as inadequate, corrupt and unreliable government support. ISALCs groups offer financial services and

lending facilities exactly where farmers are by mobilizing savings and lending services to club members. These savings clubs are not a new phenomenon, as they have operated in the country since the 1970s, but with certain modifications they continue to play an important role in serving the savings and lending needs of the largely neglected small-scale sector at least. Although loans often have high monthly interest rates, when well-managed many members generate very high returns on their savings. Given their importance, resuscitating those ISALC groups that are struggling is essential.

Dairy Association A, a dairy association of milk producers, was found in the area located in 'small-scale farms', where it built a milk collection center (MCC) with support from Red Dane Dairies. Before the Zimbabwean crisis, in the 1990s, milk producers in this area enjoyed a positive growth trend, but this was adversely affected by the economic decline during the period 2000 to 2008, when a significant proportion of its members abandoned milk production. However, upon noticing the increasing demands for milk and milk products dairy farmers re-oriented themselves towards this strategy in times of crisis. Their initiatives were backed by financial support from EU STABEX/NADF, with a heifer revolving fund and capacity-building support from Land 'O' Lakes and Keffalos between 2010 and 2013. In 2015 additional support was provided by Aldington for a cattle-bank fund. This has strengthened the association's members, who increased from 26 active members in 2012 to 38 in 2016. Being part of an organized association saw a high proportion of members' households owning different forms of milk infrastructure and utensils. About 82% of the association's members had milk pens, 45% paddocks, 53% cattle-handling and milking parlors, 81% cattle kraals, and 96% stainless steel buckets. Collectively the association's members have been able to maintain the MCC infrastructure and invest in repairs and renovations where necessary, but more importantly milk farmers reported receiving regular pay-outs fortnightly from their milk deliveries.

Active members of the association (91%) have made improvements over the years to breeds and milk quality. 83% depend on milk as their main source of income, 16% regard milk as a second income source, and 11% as a third income source. The highest proportion of members whose main source is milk production is therefore significant. Among these farmers, some started specializing mostly in milk production by investing in milk infrastructure and utensils, growing the milk herd and producing fodder to ensure adequate feedstock. All these efforts, coupled with the improved management of milk cows, have increased milk output and deliveries to the MCC. Such improvements can be attributed to infrastructure (both collective and individually) and the vast knowledge that has long been disseminated and shared among active members, as well as the training offered by Aldington. In addition to sharing knowledge and information, training is more easily organized for groups than individually. 97% of the association's members received training in different production skills, of which 94% deliver milk to the MCC regularly. However, 17% of the registered members are inactive, a quite significant proportion. This shows the difficulties some farmers have, even though the majority have fared better. Despite the great potential farmers have to improve incomes through milk production, the inactive members struggle to keep pace with the active members. Although the majority of active members have enjoyed a positive growth trend during the crisis period, there is still a lot that can be done to increase dairy herds further for the majority of households. Improvements in breed quality are very important, including the expansion of production volumes and the diversification of production to include goat's milk production (which is largely unexploited, despite the huge flocks of goats in the area), marketing and value addition. Given the current demands for milk and milk products in the country and region, such improvements will certainly increase output and incomes for milk producers in this area.

These groups were initiated within communities, where households came together, identified land that had mostly been donated by the village head(s) and started clearing land, digging canals, terracing for the community in an intact landscape, drafting constitutions and agreeing on the average size of plot allotted to each member. After this groundwork was completed, some group representatives, mostly the elected committee consisting of the chairperson and vice-chair, secretary and vice-secretary, treasurer and committee members, were tasked to approach NGOs for help with materials

such as fencing, pipes and seeds for the first year. There are six such groups in the community in intact landscape, whose membership differs based on the size of the irrigation project, and one group for a community in the impoverished landscape. These groups were backed by NGO support in providing the requested materials, together with support from extension services as part of the financial support program.

Working in organized irrigation groups induced about 65% of households to concentrate their production on irrigated land, thereby reducing cultivated land by shifting cultivation to irrigated land with long fallow periods for many of their fields. Long fallow periods on fields saw the regeneration of tree species and the creation of new ecosystem services, such as woodlots for some and paddocks for others. Provision of NGO extension services to irrigation groups saw a high level of adoption of sustainable land-use practices, such as conservation farming, to help improve the already poor sandy soils by integrating crop with livestock production. This resulted in group members intensifying production on irrigated land, where about 75% of households increased productivity from a previous low of 0.8 tons per hectare to 4.0 tons per hectare through concentration and intensification. By virtue of them working in groups, their access to extension services became high, as extension agents found it easier to work with groups than with individuals. The benefits of increased access to information and advice and the investment in soil and water conservation works have been evident over the past five to ten years. Increases in yields resulted in increased incomes, as more than half of group members produced a surplus which they sold to traders or used in exchange for labor.

The ***unorganized*** households reported being constrained in increasing productivity, as they find it extremely difficult to establish, e.g., irrigation on their own except for those households that are wealthy. Also, households that work individually lack access to information, which is often shared by the groups of which they are not members. However, in the case study located in 'intact landscape', occasionally they allow non-members to attend their meetings, and some are hired to work in irrigation plots. While non-members benefit from the sale of produce by these groups, they miss out on also earning an income from the same activities as those that belong to an organized group. In the case study located in the 'resettlement area', where all households work individually, they find it difficult to come together and challenge, for example, the allocation of land previously earmarked for grazing purposes. This has in turn affected the amounts of livestock affected households can have at any given time. In contrast to organized households, those that are not organized often suffer high transaction costs in delivering their farm produce to markets, while those that are organized do this collectively, thereby reducing the transaction costs. The situation of households with regard to social organization was strongly correlated with one of the personal features analyzed (Table 41).

Table 41. Spearman correlation coefficients between social organization and the other analyzed features including p-values

	Farm assets	Farm size	Remotn.	Age	Gender	Educ.	Family size	Farm expnce.	Financ. situation	Extens. services	Financ. support	Social orgnt.
Social orgnt.	-0.06	-0.01	0.44	-0.04	-0.13	**0.05***	-0.08	-0.02	0.17	0.41	0.72	1.00

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

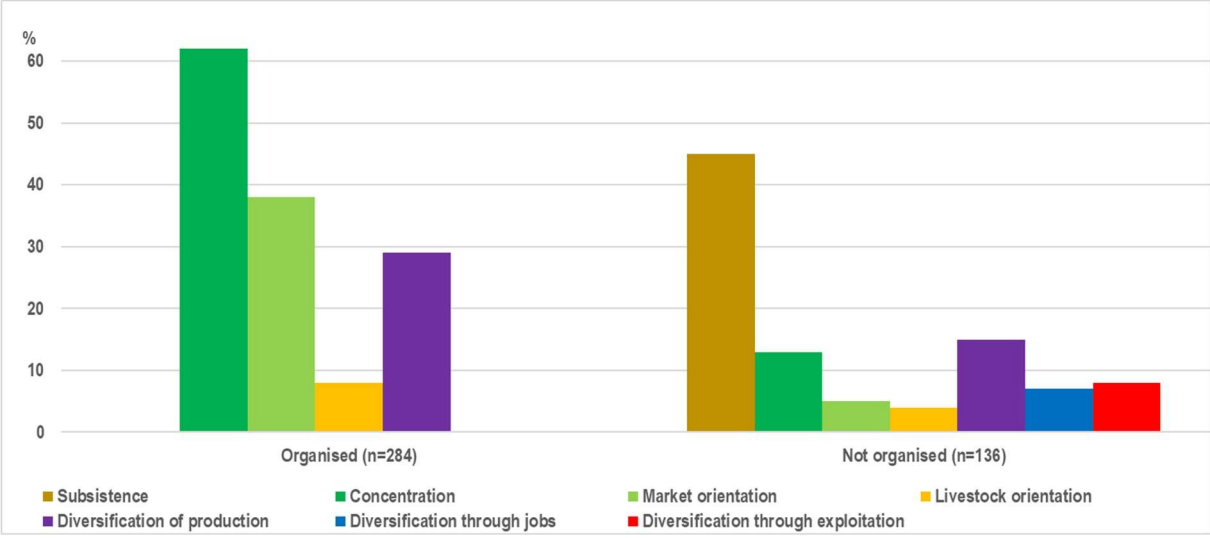
Most significantly, the level of education of the household head was positively correlated with the participation of the household in associations or other organized groups. For example, members of the dairy association, farmer groups, irrigation groups and internal savings and lending clubs were either highly educated or educated up to Form II level. This was evident from records kept for these groups, including a clearly elaborated constitution signed by all members and binding each and every one of them to abide by the rules set out therein. No significant correlations were found for the other analyzed features except for education.

Responses

Households belonging to the two social organization categories showed strongly different response patterns (Figure 28). Most of the **organized** households concentrated or diversified their production,

or became more market oriented. None of the households in this category started to exploit resources or switched to subsistence farming. During crises, a third of these households managed not only to invest in production for their own consumption, but even started to produce cash and food crops intensively for the market. In particular, those 60% of farmers who concentrated their production reported a significant increase in productivity per hectare compared to before. Working in groups enabled them to produce a surplus regularly, which they sold to raise an income. In sum, this made the organized households more successful in pursuing the concentration strategy compared to the not organized households. Similarly, being part of an organized group also positively influenced the possibility of farmers making the necessary investment in diversifying production, thereby responding to emerging market opportunities, for example, when the prices of vegetables rose. Thus, concentration and diversification of production nearly always went along with market orientation. Organized farmers were well connected with relevant platforms and networks (e.g., tobacco auction floors, milk collection points, the GMB, millers etc.), which in turn even enhanced their competitive market advantage. These farmers reported realizing substantial incomes which they used to purchase inputs, pay school fees, buy assets and make improvements to their homesteads. Accordingly, the majority of the organized farmers become better off economically and more food-secure than the unorganized farmers.

Figure 28. Proportion of farmers' responses to crises by social organization categories



Unorganized farmers showed a wider range of responses, including an (re-)orientation towards subsistence and exploitative land uses. In comparison to the organized households, they had fewer options in responding constructively to crisis situations. Most critical was their inability to concentrate their scarce resources effectively, as they often worked alone, and they lacked the advantage of being helped by others in a group with a shared vision and interests. They also lacked the means to invest in diversification, which further increased the risk of food shortages in a bad season. The majority of these farmers, who are poor, produced only what they ate, often not enough to see them through to the next farming season.

Statistical significance of the found differences

A probit regression on the influence of social organization on the household's responses in times of crisis revealed some statistically significant relations, particularly with regard to concentration, market orientation and diversification of production (Table 42).

The strongest difference was found with regard to concentration. Thus, compared to households that are not part of an organized group, those that are organized in groups opted significantly more often for this response in times of crisis. This was more evident in communal area case studies that are located in 'intact and impoverished landscapes.' The probability of concentration is significantly higher

with increasing social organization. Also, another strong difference was found with regard to market orientation, which was significantly higher with increasing social organization. Households with milk cows were organized into a dairy association, others into irrigation groups, farmers' groups, or internal savings and lending clubs. The analysis also confirmed the capacity of socially organized households to diversify production effective. With regard to all other response types, no statistically significant correlation was found.

Table 42. Probit regression of social organization and responses

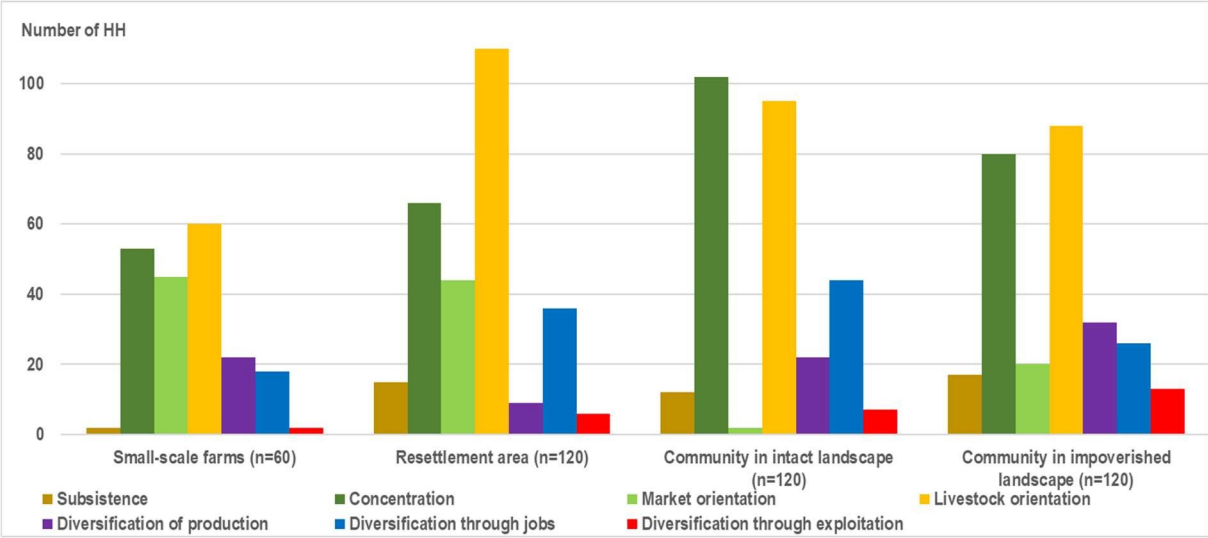
Response	Social organization category	Estimate	Standard deviation	z value or standard score	Pr (>lzl) values/level of significance
Subsistence orientation	Organized	-5.216674	362.022425	-0.014	0.9885
Concentration	Organized	2.20550	0.37034	5.955	**2.59e-09*** **
Market orientation	Organized	-2.22876	0.58833	-3.788	**0.000152*** **
Livestock orientation	Organized	0.20532	0.72009	0.285	0.77554
Diversification of production	Organized	1.277873	0.389438	3.0281	**0.001033** **
Diversification through jobs & remittances	Organized	0.01001	0.66652	0.015	0.98801
Diversification through exploitation	Organized	-4.658051	380.059126	-0.012	0.9902

Significance codes: ***=0.001 (99,9% chance of being true); **=0.01 (99%); *= 0.05 (95%); and =0.1 (90%)

4.3.4 The specific contexts of the case studies

The specific contexts of the four case studies also influenced the decisions and options farmers took in response to the crisis. Some of these contexts were individual, others collective, relating to the availability of water sources, land tenure and distance to markets. Figure 30 provides a summary of the major findings based on the specific contexts of the case studies.

Figure 29. Number of farmer households in the four case studies that opted for the different crisis response categories



As well as the influence of farm-level, personal and institutional features, context-specific features also influenced livestock orientation, concentration, market orientation and diversification through jobs and remittances in particular across the four case studies. However, each case study had unique features which played a role in deciding the most appropriate strategy in the area.

In the 'small-scale farms' case study, all farmers responded to crises by increasing livestock. This was mostly influenced by the large farms they owned, but most importantly the individual situations on self-contained farms with reasonable grazing space made it possible for them to grow their herd size. Also, formal land ownership allowed farmers to decide which production system to follow, as close to two thirds of households were rearing milk cows. An increase in livestock enabled farmers to concentrate their scarce resources efficiently using inexpensive manure. The study found that distance had a very strong statistical significance on market orientation in terms of nearness to the MCC and to

the main markets for production of tobacco and other farm produce. These formed the major responses for this case study, with an above-average number of farmers having opted for such strategies. The other strategies were far below the average, including diversification through jobs despite nearness to the capital Harare, which shows that the majority of farmers preferred to work and earn from farming, as they remained on the farm.

Similarly, medium-size, individualized and self-contained farms in the 'resettlement area' case study induced the majority of farmers to increase livestock production. Farmers in this case study had access to common grazing land in every village, and this effectively encouraged farmers to grow their herd size. This in turn gave them the means to produce their own manure and have their own draught power, which enabled most of them (above the average) to concentrate their production and increase yields both for their own consumption and for the market. Distance to markets also played a critical role in influencing an above-average number of farmers in this case study to produce for the market. Slightly below the average were farmers who opted to diversify through jobs and remittances, which was again influenced by the distance to urban centers. The other responses fell by far below the average, thus making them unimportant strategies or options of choice for the majority of the farmers in the case study except for the poorer households.

The 'community in intact landscape' case study had abundant water reservoirs that encouraged a majority of farmers to concentrate production in irrigation projects, leaving several yields fallow. Limited grazing land in communal areas, as found in this case study, often limit the number of livestock a household would have, but in response to crises, instead of cattle, more farmers started to rear small livestock. In drier areas like these, farmers also preferred small livestock, which are more drought-tolerant than cattle. This case study is surrounded by large-scale commercial farms, which often hire labor from communal areas, this in turn influencing slightly above the average of the households in this case study to diversify through jobs, while others migrated far away, to urban centers as well. Also, dry climatic conditions induced the farmers in this case study to diversify crops and livestock more as a way of spreading the risk and accumulating diverse foods for household use. Even farmers who worked on irrigation projects were more diversified in the number of crops they grew, often on rotational basis, while others used intercropping. The other responses fell far below the average, with market orientation almost non-existent, because of the distance to markets: this case study is located further away from markets, and any surplus yields are sold within their local markets.

For the 'community in impoverished landscape' case study, the area is highly degraded, with bare valleys, hills, mountains high aridity levels, but still the majority of farmers responded to the Zimbabwean crisis by increasing their livestock numbers. However, they mostly switched to small livestock, which are more resistant to drought, with fewer cattle than those found in the first two case studies. Due to dry climatic conditions, farmers responded by concentrating their production, often combined with sustainable technologies to conserve water and improve soil fertility. Such climatic conditions also influenced farmers in this area to diversify their production (slightly below the average) as a way of spreading risk and to increase the variety of food available to the household. Distance to the provincial town and diversification through jobs and remittances have strong statistical significances, but also the community is surrounded by both medium and large-scale farms, which hire labor seasonally from communal areas. Some farmers responded by orienting themselves towards markets through tobacco production, besides drawing on external support from private companies. The area often receives normal to above normal rainfall, which is critical for the growth of tobacco, hence a few farmers, though below the average, switched to tobacco farming. The area is endowed with mineral deposits, leading some households to turn to the exploitative strategy of mining gold along the river banks.

5 DISCUSSION

5.1 Principal findings

There are three principal findings for this research study. First, the crises adversely affected farmers; secondly, farmers effectively reacted and responded to the crises; and thirdly, support and resource endowment are critical to overcome crises. These findings are discussed in the following sections.

5.1.1 Crises strongly affected farmers

More than fifteen years of political and economic crisis in Zimbabwe, in combination with frequent droughts, profoundly changed the conditions under which rural farmers in the country live and produce. The most striking manifestation of this complex crisis situation was the breakdown of public services, including the progressive reductions in public services providing technical and financial assistance, and, partly related to this, the increase in corruption. For example, although the ruling party announced million-dollar tractor and farm mechanization programs (Table 14) during election years, not one of the farmers from the four case studies received anything. The most critical change was that the state-driven Grain Marketing Board failed to continue offering support to maize farmers with regards to pricing and payment patterns, which led to a massive decline in the production of maize, the key business of many farmers at that time. This withdrawal of the state was further compounded by a massive distortion in the markets, making the profitable marketing of their own production considerably more difficult or even impossible for farmers, as well as leading to unaffordable agricultural input prices. The latter forced a majority of farmers to skip using fertilizers, certified seeds and pesticides. Only about 28% managed occasionally to apply sub-optimal amounts of fertilizers on smaller portions of their field. Devastatingly, farmers also suffered animal losses to drought (especially the extreme drought in 2015/2016 season) and animal diseases that hampered them in using manure to maintain soil fertility. In parallel, farmers were heavily affected by climate change, manifested through increases in dryness, soil erosion and unpredictable rainfall. This was especially hard for farmers working in the dry conditions that are typical of large parts of Sub-Saharan Africa, where water is the factor that most limits production and where agricultural activities depend on the predictability of rainfall during the sowing period, or on the availability of groundwater and water reservoirs in the mountains during the growing period. This critical situation was at least partly mitigated for more than a third of farmers (38%) through the interventions of donors, NGOs and private companies, who, in contrast to the government's initial strategy of distributing technical packages, promoted low-cost technologies in the case of development organizations, and contract farming in the case of private companies. Nevertheless, the situation of crisis resulted in considerable losses of harvests, plants and animals, particularly in the very dry years of 2002-2003 and 2015-2016, when some crops were a complete write off. Another issue here was political violence, through which livestock and harvests were looted, for example, in the aftermath of the 2008 election. Despite these difficulties, the vast majority of the families remained on their properties and tried to cope with the challenging situation. This applied even in resettlement areas, where the government had distributed the land of expropriated white farmers: all farmers who had been resettled at the beginning of 2000 remained on their farms and in 2015 were joined by new farmers occupying grazing land 2015. Roughly a third of households (29%), however, decided to send a member or two to urban areas, abroad or to other farms to search for remunerable employment outside the farm. As the young male adults were mostly drawn into leaving the farm for employment, the most common consequence of this across the case studies was that women, children and the elderly were left with the task of managing farm operations.

5.1.2 Effective responses of the farmers

In response to this situation of crisis, the farmers in the case studies employed a wide range of strategies. Responses included reorientation towards livestock, the reduction of land area under cultivation, the adoption of low-input farming systems, intensification, on- and off-farm diversification, migration, re-orientation to subsistence farming and the unsustainable exploitation of common resources. Mostly, farmers combined two or more of these responses. Where possible, nearly all households (84%) started to buy livestock when the crisis arose, whether cattle or small livestock, the latter seen as being resistant to drought and easy convertible into cash. To improve food security,

many farmers (71%) reduced and concentrated their inputs on the most suitable pieces of land to optimize the application of scarce resources. Upon realizing surpluses, some farmers (15%) then included tobacco as a cash crop, or even diversified their production portfolios more strongly (20%). Only traditional dairy farmers (10 %) largely continued their production because they often b belonged to the second or third generation of farmers and thus had the knowledge and experience to continue and even intensify production. Also, migration and the consequence transfer of remittances became a central resource for many families (29%). Accordingly, concentration and diversification were closely linked to market orientation. Those farmers that produced for the market were well connected to relevant platforms and networks (e.g., tobacco auction floors, milk collection points, the Grain Marketing Board, millers etc.), and used their surpluses for farm investments and to grow their asset base. Also, those farmers who received remittances invested in farming, often accompanied by a diversification of production. The switch to low-cost technologies and the concentration of production on the most suitable pieces of land massively reduced their dependence on the government's subsidies. In parallel, many farmers managed to significantly enhance the productivity of their area, so that overall production remained stable, despite a significant reduction in the area of land under cultivation. Some farmers even managed to increase their gross incomes by intelligently combining on-farm and non-farm strategies. The concentration of farming activities on the most fertile areas of land further allowed fields to be left fallow and other ecologically valuable land uses, such as woodlots, to be exploited. This effect was particularly visible in contexts that already showed a high level of degradation. Only 7% of farmers became engaged in unsustainable exploitative activities, but every tenth household was forced to reorient itself towards subsistence farming. However, about 75% of the households in the case-study sites had somehow found effective ways to cope with the Zimbabwean crisis, implying that the vast majority of farmers substantially changed or adapted their livelihood strategies. While in 2000 most farmers were dedicated to the production of maize and dairy for income generation purposes, in 2016 livelihood strategies were diversified to cover the production of food, dairy and cash crops, and off-farm employment.

5.1.3 Support and resource endowment are critical

The specific choice and quality of farmer's responses varied greatly in accordance with institutional, farm and personal features, except for the consistent orientation towards livestock across all farmers and case studies. In particular, four factors had a highly significant positive influence on the success of farmers in implementing concentration, market orientation and diversification, namely the availability of farm assets (particularly ownership of cattle), financial support, the level of social organization, and formal tenure arrangements. Market orientation was also favored by accessibility. Other factors had a comparatively low influence on farmers' responses, except for a preference among older and female-headed households for diversification. With regard to remittance support, higher educational levels and a good financial situation in the households played a moderate positive role. The picture was less clear with regard to the factors that influenced responses with questionable livelihood outcomes, such as re-orientation towards subsistence farming (lack of assets, low level of education, households headed by females without husbands) and exploitative strategies (male-headed households and households headed by females without husbands). There were also large differences between the case studies with regard to the factors listed above, but also due to important contextual differences. Most strikingly, the better the situation for a case study, as in 'small-scale farms and community in intact landscape' with regard to accessibility, water availability and social organization, the stronger its external support. In response, more farmers in the favored case studies took up the opportunities offered mainly by tobacco companies and development organizations (irrigation and dairy farming). An exception was the resettlement case study, which, as a contested area, was disregarded by development organizations, despite its favorable environmental conditions. Accordingly, in the least favorable case study, 'community in impoverished landscape', households were largely left to their own devices in their difficult situations with the challenge to sustaining their livelihoods. They more often re-oriented themselves to subsidence farming and switched to small livestock, thereby managing at least to secure the basis of their food supply.

5.2 Reflections on the applied methodology

The adoption of a mixed qualitative and quantitative approach in respect of the methodology used in this thesis had the potential to answer research questions that were based on a representative sample of a typical cross-section of small-scale farmers found in semi-arid regions in Sub-Saharan Africa. Like any other methods, those adopted here also had their flaws, which will be discussed below in order to improve future research on the topic.

5.2.1 Representativeness

Zimbabwe provides a representative case study of a country in crisis in Sub-Saharan Africa. However, the situation in Zimbabwe is somewhat unique in that for more than fifteen years the country's political, economic and social crisis has deepened (Sachikonye, 2011), as well as suffering devastatingly from frequent droughts (Brazier, 2017). However, crises are not peculiar to Zimbabwe alone, as almost all the countries in Sub-Saharan Africa have been affected by the impacts of climate change, such as the increased frequency of droughts, extreme temperatures and heatwaves reported to be on the increase in many parts of Sub-Saharan Africa (Brazier, 2017; Makate et al., 2016). Farmers located in the semi-arid regions of such countries are hardest hit, particularly countries that experience political instability, such as the civil war in South Sudan, repeated election violence in Kenya and the armed conflict in the eastern Democratic Republic of Congo (DRC). Consequently, these crises are reconfiguring the conditions of small farmers, most particularly those located in the vulnerable contexts of the rural tropics, who would be forced to adjust and adapt to the changes in their working environment. Outside the African continent, climate change and in some cases political and economic crises has wreaked havoc among Arab countries such as Syria, Yemen and Libya, Asian countries like Afghanistan, Vietnam and the Philippines, and in Latin American countries like Venezuela. In terms of changes to climatic conditions, the whole world is threatened by the devastating effects of climate change, with a majority of the small farmers across the globe being hardest hit.

As such, the results for this research are valid not only for Zimbabwe, but also for other Sub-Saharan countries beyond the context in which small farmers suffer from one or other form of crisis that reconfigures their conditions and compels them to adjust and adapt to such changes in a variety of ways. However, these results are not valid for contexts that enjoy relative political and economic stability, with functioning public services, nor for areas where drought has had a minimum impact on agriculture, as in agro-ecological zones that are naturally wet. Such contexts exist in areas with tropical rainforests and woodland savannah that receive rainfall almost all year round, hence the farmers in such contexts do not have to respond in the same way as farmers in drought-prone regions do.

The four ***case studies*** represented typical rural villages found in semi-arid regions in Sub-Saharan Africa. Such rural villages have a similar historical background in that colonial administrators relegated most African farmers to marginal lands with poor soils in agro-ecological regions devoid of natural water, financial and extension support and with poor road networks. This study confirms the findings that the majority (70%) of small farmers in Sub-Saharan Africa live in semi-arid areas (Chibarababa et al., 2017; FAO, 2010) under precarious conditions (Pokorny, 2013), as evidenced in the four selected case studies. Consequently, colonization in Africa has led to the deprivation of many rural farmers from accessing fertile land and adequate public services, a characteristic that is common among most African countries, one that current governments have failed to address. Rural villages in some semi-arid areas are easily accessible, while others are inaccessible. As shown in this study, production systems differ by contexts and natural resource endowments, such as the availability of groundwater or water reservoirs that can be used to modify production periods, these being found not only in Zimbabwe, but also in other parts of Sub-Saharan Africa and beyond. Therefore, the results of these case studies are valid for Zimbabwe, where about 70% of the rural population live in semi-arid areas (Matondi and Dekker, 2011; Hassan and Nhemachena, 2008), which are dry, have poor soils and lack the support of public institutions, a situation that is common among poor farmers across Sub-Saharan Africa. The results are therefore also valid for areas of Sub-Saharan Africa faced with the same challenges, as well as for small farmers in similar situations elsewhere in the world, with particular

relationships with their responses to the impacts of climate change and to political and/or economic crises.

5.2.2 Data gathering

A few issues arose with in gathering data, which should be avoided in future studies, including the unbalanced representation of stakeholders and an incomplete picture of the local reality. However, these flaws do not in any way compromise the methodological potential or validity of the research results.

Unbalanced representation of stakeholders

The representation of stakeholders in the participatory mapping exercise was somewhat unbalanced, as some participants did not show up for the exercise, leaving only a few to embark on it. In one case study, the mapping exercise was carried out by extension agents and two farmers, while in another only village heads did the exercise. In addition, interviews were conducted with key experts, including donor organizations, private companies, Rural District Councils (RDCs), extension agents, the Environmental Management Agency and local leaders, that is, chiefs, councilors, village heads and church leaders. The chances of them reporting what they wanted the researcher to hear could be high, but there was nonetheless consistency in the information received from the different experts interviewed across the case studies. Also, the same data were confirmed later in interviews with lead farmers and selected farmers for each response category during field walks.

Incomplete picture of local reality

Time pressures and the choice of both questions and people resulted in a somewhat incomplete picture of the local reality. A study of this magnitude would require spending more time in communities to acquire a complete picture, but as with any study there is a time limit on the research. Structured questions were used to obtain specific data, but there was the drawback of a lack of depth, for example, regarding emotions or feelings, which often are attached to some of the decisions people take. To obtain knowledge of these required more time using at most unstructured questions, but due to time constraints these were not incorporated in the data-gathering or the questions that were formulated.

Feelings and emotions are best described by those having experienced situations of crisis. However, the choice of persons for interviews mostly fell on experts except for one or two households whose members from each identified response category were accompanied on field walks. Nonetheless, this omission of unstructured questions with which to gain an understanding of the emotions and feelings of affected farmers did not compromise the validity of the study results.

5.3 Looking again at the state of knowledge

5.3.1 Manifestations of crises

The study found almost all the manifestations of crises outlined in the state of knowledge chapter. However, three specific manifestations were of great significance, namely the reduction of public services, climate change as a crucial threat to farmers' livelihoods and market distortions. These three manifestations are discussed in the sections below.

5.3.1.1 Reduced public services

In accordance with the findings of Kimenyi et al. (2014), this study contributes to the existing body of knowledge in which crises manifest themselves through the reduction of public services, particularly by weakening extension services and reducing the capacity of banks to serve poor farmers. The study revealed that the state significantly reduced its support to and expenditure on research and extension services, as also found by (Djurfeldt et al., 200%). Although the state continued to offer its extension services to farmers, only minimum services were provided, while farmers located in remote areas had irregular services or none at all. Besides a cut in budgetary allocations to the Department of Agricultural, Technical and Extension Services (AGRITEX), the decline in public services was also a result

of corruption by the political elite, who embezzled and misappropriated much of the public funding raised to help small farmers with inputs or tractors, which never reached the farmers in the study sites. This finding is also confirmed by Olaosebikan (2010). The study shows that the withdrawal of the state forced some extension agents into rent-seeking behavior, from which only rich farmers who were willing to pay benefited, while the majority lacked access to climate change and market information, hampering their capacity to cope effectively with the situation of crisis, particularly during drought periods and the resultant exclusion from markets. It became clear that the most highly affected farmers were those located far from markets and in inaccessible areas, who had to revert to the use of indigenous knowledge systems of trial and error and imitating others. This finding is in line with the FAO's 2005 findings. Most strikingly, the study shows that efforts to interact with mostly poor farmers under severe weather and logistical conditions in order to influence their behavior positively were seriously hampered during the Zimbabwean crisis.

The study also confirms the disruption of financial support from the banks, as pointed out by Kimeni et al. (2014). The study illustrates that the banks' capacity to provide loans and credits to rural farmers during Zimbabwean crisis periods was seriously hampered, with many of them either reducing lending or even ending the issuing of loans to farmers altogether. The withdrawal of support to farmers had serious implications for already poorly resourced farmers, who need cash to buy inputs (seeds, fertilizers, pesticides), forcing most of them to simply skip using such inputs. The few who continued to use these inputs were only able to apply sub-optimal amounts of fertilizers on smaller portions of their fields. However, the study illustrates how donors, NGOs and private companies partly covered the gap in financial support for the establishment of irrigation schemes, new technology transfers, animal husbandry and a milk-cattle bank from donors and NGOs, as well as contract farming by private companies. External support thus played a crucial role, as outlined by Moll et al. (2004), as it boosted farmers' capacity to produce enough for their families, as well as for the market, where much of their income was earned. However, not all farmers were supported: less than a third of farmers received external support, leaving the majority who had the least capacity to cope effectively with the situation of crisis without support. Some started to engage in low-return non-farm activities such as wood collection, illegal mining, brick-making and stream bank cultivation to ensure survival, reduce vulnerability and avoid sinking deeper into poverty.

5.3.1.2 Climate change is a crucial threat

As several scientists have pointed out, climate change poses a huge threat to the livelihoods of many poor rural farmer families in Sub-Saharan Africa (Brazier, 2017). This study also shows that climate change indeed threatens farmers' livelihoods and food supply in Zimbabwe. This development is associated with stressors that destabilize farmers' livelihood systems, particularly among poor farmers living in semi-arid regions. Interestingly, Zimbabwe's livelihood zones show that most livelihood activities (crop and livestock production) in the country are based primarily on rainfall, making them highly susceptible to climate-related disasters and making rural farmers more vulnerable to shifts and changes in the climate. The study confirms the already available scientific evidence showing that climate change has caused aridity in some regions (IPCC, 2019; Schewe and Leverman, 2017, Sarr, 2012). The frequency and intensity of droughts and the increases in temperatures and heatwaves (Sutanto et al., 2020; Schiermeier, 2018) and extreme climatic conditions are expanding the areas under dry climatic conditions further (Brazier, 2017). Rainfall unpredictability is worsening these climatic conditions, particularly with the frequently observed shift to a late onset of rains and early cessation, drastically reducing the growing period and negatively affecting local farming, especially in semi-arid regions (Sarr, 2012). Under such conditions and in the context of the case studies, particularly for the community in impoverished and intact landscapes, business as usual is not possible, and farmers must make adjustments and adapt to the ever-changing conditions. Thus, climate change poses a crucial threat to farmers' livelihoods and food supply not only in Zimbabwe, but also in Sub-Saharan Africa and globally, as climate change knows no boundaries. However, like most developing countries those in Africa are being hardest hit by the impacts of climate change (Brazier, 2017). Climate

change exerts pressure on ecosystem services through overexploitation and the poor management of resources.

Adverse coping strategies

As shown in this study, poor farmers who lack assets, cash and information are highly constrained in coping with climate-related shocks and stressors, which may force them to adopt adverse coping strategies, which, as the study shows, are short-term survival techniques that tend to undermine overall well-being in the medium- to long-term (Zimbabwe Human Development Report, 2017). Such short-term coping strategies often include disposing off of productive assets, the over-exploitation of available natural resources, such as wood collection, brick-making, stream bank cultivation, gold panning and many other destructive activities. Such alternative strategies also depend on rainfall distribution and quantity such that inadequate or erratic rainfall will have devastating effects that subsequently reduces their capacity to guarantee food for their families. Also, immediate reactions to shocks and stressors, such as the reduction in food consumption, may have potentially irreversible consequences, like stunting among children. People whose immune systems are compromised eat less nutritious foods and may resort to behavior that undermines trust and social standing, such as commercial sex-work, early marriages, moving and living on the streets, begging and theft.

Impact on crop production

In southern Africa, the Intergovernmental Panel on Climate Change (IPCC) forecasts a 20-50% decline in the yields of staple crops, an outcome that is already evident in Zimbabwe. Scientific evidence shows that agriculture in Zimbabwe is sensitive to climate change, with significantly lower crop yields and reductions in the plant-crop growth period due to unpredictable rainfall and extreme weather events such as droughts and mid-season dry spells. To compensate for these water shortages, the farmers in the case studies modified the growing length through irrigation. However, the continuous decline in groundwater and water reservoirs makes farmers and communities in semi-arid areas more vulnerable to future droughts and long dry periods, particularly those farmers who rely on irrigation.

Impact on livestock production

Several studies have shown that livestock, especially cattle, are an important source of food, income, draught power, transport and a safety net for the majority of farmers in Sub-Saharan Africa (FAO, 2019; Bras and Solo, 2014; FAO, 1995). However, the impacts of climate change are expected to heighten the vulnerability of livestock systems and reinforce existing factors that affect livestock production, such as animal diseases and insufficient grazing (Zimbabwe Human Development Report, 2017). This study shows the importance of livestock ownership, especially cattle, as a key farm asset that measurably reduces households' vulnerability to extreme events associated with natural and human- induced disasters, as demonstrated by farmers in the small-scale farms and resettlement area. However, farmers lose their livestock during droughts, which in turn reduces the number of livestock owned by households, while those with few livestock may lose everything. This plunge affected households into chronic poverty, and it will not be easy for the majority of poor farmers to replace livestock lost due to disasters.

Increased temperatures, droughts and rainfall unpredictability

In support of the various pieces of evidence indicating that extreme weather events have seen an increase in temperatures (IPCC, 2019; Brazier, 2017), this study shows that farmers have used groundwater and water reservoirs to compensate for water shortages caused by extreme temperatures, droughts and rainfall unpredictability over a long period of time. Increased temperatures and droughts affect both crops and livestock production, as already mentioned. For livestock, the availability of pastures is reduced by the link between the degradation of climate change ecosystems, for example, moisture deficiency, and the impact of wildfires in destroying forage. Also, the livestock numbers are reduced drastically when there is limited rainfall, and production falls with it. Increased temperatures also alter the primary production of crops and forage and plant materials during droughts or as a direct result of increased temperatures, thereby reducing the nutrients

availability for crops and animals. In accordance with research showing that crop yields and cattle numbers decline dramatically in drought years, the study confirms that climate change will be a crucial threat to farmers' livelihoods and food supply, both now and in the future. If these farmers continue with the same land-use practices and lack support, as is the currently the situation, food supply might be seriously compromised. Also, experience shows that in Zimbabwe drought and extreme high temperatures are driven by the El Niño phenomenon, having devastating impacts on rural households, particularly those located in dry areas such as agro-ecological zones III, IV and V (see p. 71). These zones are characterized by relatively high temperatures and infrequent, heavy rainfall, and are subject to seasonal droughts, severe mid-season dry spells and climate change, making such zones drier (Brazier, 2017; Sarr, 2012). Droughts and increasing temperatures also lower the reproduction of calving rates. In the country, heatwave conditions associated with climate change have shown a 10-14% reduction in milk production in dairy cattle (Zimbabwe Human Development Report, 2017). Dairy cattle do not often recover even after conditions return to normal, having devastating impacts on households that depend on dairy production as their main source of income.

The situation of crisis is proliferating due to climate change and will have serious repercussions on the livelihoods and food supply of farmers, particularly those in semi-arid regions. Their ability to stay in these areas in the future is made uncertain by these ever-changing climatic conditions, which may trigger migration with global consequences.

5.3.1.3 Market distortions

In accordance with the findings of Wiggins et al. (2009), this study confirms that crises cause market distortions, which in turn push the prices of inputs up and those of outputs down. As this happens, high input costs make production and its marketing unprofitable or even impossible for poor farmers. The study shows, that due to market distortions, the prices for certified seeds, fertilizers and pesticides all went up, resulting in the majority of farmers simply skipping the use of such costly inputs in preference to inexpensive animal manure and uncertified seeds, which are retained from previous harvests. However, use of retained seed causes low yields and increases food insecurity. The study also shows the role of corruption in public input distribution and increased market distortions. Undeserving politicians and their close relatives and friends who received inputs at the expense of deserving poor farmers fueled parallel market rates, as the prices were unregulated and often well beyond the reach of the majority of farmers. For this reason, farmers often take fright at price hikes for inputs and plant less, use fewer costly inputs or even skip them entirely. In support of the findings of Minde et al. (2010), this study shows that the few farmers who continue to use fertilizers applied sub-optimal amounts to smaller portions of their land. This in turn causes a decline in production, food insecurity and shortages of raw materials for agro-businesses, who in the case of Zimbabwe were pushed out of business.

Market distortions are also responsible for falls in output prices. In the case of Zimbabwe, the study shows how the majority of farmers abandoned the production of maize, a staple and also a cash crop, due to the poor prices for the commodity (Dekker and Kinsey, 2011). Consequently, the reduction in maize production threatened not only the food security of households but also nationally, and even worse, industries that rely on it as raw material for the manufacturing of other products were forced out of business, and many people lost their jobs.

5.3.2 Major responses to the situation of crisis

As a response to crises, farmers often combined a wide range of on-farm and off-farm activities. However, the major responses included increased livestock rearing, concentration, market orientation and overexploitation. There were also immediate responses that farmers make in times of crisis, which include food compromising and finance-coping strategies. A discussion of the relevance of these major responses is given below.

5.3.2.1 Multiple benefits of increasing livestock-rearing

It is common practice for African farmers to integrate crops and livestock as a production system (Bras and Solo, 2014). However, the study also found that in response to the Zimbabwean crisis, farmers actually increased livestock rearing. The study showed that about 84% of the farmers in the case study sites increased the rearing of both large livestock, particularly cattle, and small livestock such as goats, sheep and chickens. Particularly the households who managed to increase their cattle had multiple benefits. As pointed out by the FAO (2019; 2016; and 2009), this study shows that livestock rearing, particularly of cattle, has multiple benefits, economic, social and cultural. As in the context of the case studies and the unavailability of tractors to till the land, cattle were particularly critical in tilling the land and controlling weeds. As farmers had no capacity to buy fertilizers to enhance soil fertility, animal manure was indispensable as an inexpensive fertilizer to improve soil fertility. In line with rearing cattle and the capacity to produce manure, the study shows that almost two thirds (69%) of farmers with cattle were able to till the soil and use manure from their own cattle, which helped them cut the costs of outsourcing tilling services and buying costly fertilizers. Also, cattle were frequently used totransport harvests from fields to homesteads, as well as being a local mode of transport to business centers and hospitals. The other benefits evident in the case study sites were the provision of milk as a source of income, as cattle were regarded as assets and savings that could be converted into cash whenever the need arises. Most striking is the use of livestock, particularly cattle, as collateral securityagainst informal loans in the absence of bank loans, which came in handy as a local credit mechanismwith measures to protect money lenders from defaulters. The study showed the importance attached to cattle ownership, which was also perceived as a measure of prosperity. Here the majority of farmerstended to accumulate assets in the form of cattle, and the more cattle a household owned, the higherits social status and the more of other assets it had.

Last but not least was the benefit of increased productivity among livestock owners who had the means to produce sufficient manure to fertilize their crops. Conversely those without this benefit were constrained in responding effectively to crisis situations, particularly because of their inability to produce sufficient manure to guarantee productivity on poorer soils, which in turn increased the risk of food shortages, especially in a bad season.

5.3.2.2 Risk- and cost-minimizing strategies through concentration

Unlike the grand theories (Blair et al., 2018; FAO, 2010) that state poor farmers abandon their land and move to urban areas, this study found that about 75% of the farmers remained on their land, being creative and innovative in finding strategies that enabled them to produce enough for their families. Moreover, the majority of households managed to increase their livestock, essential rural 'wealth' or 'farm assets' critical for the production of the much-needed manure to improve soil fertility and productivity. The study showed that about 75% of rural households in the case-study sites had managed to cope with the crisis situation. Particularly those who opted to reduce and concentrate inputs on the most suitable parcels of land shifted to commodity production and to diversifying and spreading the risk across several activities, crops and livestock. Many of the observed strategies were successful in guaranteeing family livelihoods, most often by optimizing the application of scarce resources on the most suitable pieces of land and by combining a range of on-farm and off-farm activities. As observed by Mohapatra *et al*. (2010) for most African countries, including our case studies, migration and remittances played a central role in putting recipient households in a better position to cope with the crisis. Such remittances enabled a majority of recipient households to invest meaningfully in their land and to diversify production. Additionally, the frequently observed strategy to reduce and concentrate inputs on the most suitable piece of land had the positive and environmental benefits of increased yields (Rusinamhodzi *et al*., 2011) and allowed the natural regeneration of shrubs and trees on fallow fields. The increase in yields on smaller cultivated areas confirms similar observations made by Rudel *et al*. (2009). Many farmers managed to enhance their productivity significantly so that their overall production remained stable despite a significant reduction in the area of land under cultivation. About 19% of farmers even managed to increase their gross incomes by carefully combining on-farm and off-farm strategies.

Following the observations of studies into the environmental effects of small-scale farming (Bongo, P. P and Bourdillion M.F.C 2001), farmer's responses to the Zimbabwean crisis may have positive effects on the stability of the natural basis and ecosystems. The switch to low-cost technologies resulted in a massive reduction in dependence on government subsidies, the use of pesticides, herbicides and chemical fertilizers. In parallel, the concentration of farming activities on the most fertile plots of land allowed the growth of field fallows and other ecologically valuable land-use elements, such as woodlots. Only 15% of farmers were engaged in exploratory activities that caused detrimental environmental effects. Interestingly, this was especially the case in contexts that already showed a high level of degradation, which partly supports the vicious circle hypothesis that degradation and poverty create more degradation and poverty (Reardon and Vosti, 1995).

5.3.2.3 Switch to cash-crop and intensified milk production (market orientation)

While niche markets for different crops like cotton, tobacco and sugarcane have been in existence for a long time in Zimbabwe, tobacco markets particularly have been heavily dominated by large-scale commercial farmers, while at the beginning of the Zimbabwean crisis, small farmers were only marginally involved in tobacco farming (FAO, 2003). As the crisis deepened and the fall in maize prices hit the majority of small-scale farmers hard, many switched to tobacco production as one of the most profitable crops, offering them a unique opportunity to earn exceptionally high producer profits and excellent rates of return compared to the maize crop (Dekker and Kinsey, 2011). This made tobacco production the backbone of income earnings among its growers, who often practice a five-year rotation with other important crops, such as maize, groundnuts, soybean and vegetables, either for food or cash. This is also confirmed in a case study by the FAO (2003). The rotational cropping of tobacco and other crops becomes an integral part of the overall land-use system, which in turn helps farmers earn a steady flow of income. Also, during the crisis many farmers who engaged with markets through tobacco production started to introduce other high-value horticultural crops ((FAO, 2009; 2006) after signing contracts with village-level institutions like schools, hospitals, supermarkets and hotels (Davis, 2006). This was done as part of their farm system, but more importantly as a way to lessen their heavy dependence on tobacco. However, in the context of the case studies, tobacco farming provides an economic basis for other production opportunities.

Also, the intensification of milk production was shown to be more profitable, particularly for farmers with more milk cows. In accordance with the findings of the FAO (2017) and UNDP (2010), dairy production in the context of the case study of small-scale farms contributed a significant share of the incomes and food of milk producers. However, the latter sell raw milk, as they have not started processing or adding value to their produce, making them lose out on high-value returns, though if the whole value chain is strengthened, these farmers stand to make substantial profits. Despite this weakness, as in the case of tobacco production, milk production provides the economic basis for other production opportunities that become critical in crisis situations.

5.3.2.4 Overexploitation

As several researchers have already observed, when faced with a decline in agricultural production and market opportunities during crisis situations, some farmers started to search for opportunities outside the farm (Campbell *et al*., 2001; Quinn *et al*., 2011). In confirmation of these findings, the studyshows that about 7% of the farmers started to intensify the collection of wood, dry-season gardening along riverbanks, brick-making and illegal gold-panning. Similar observations were made by Campbelland Trechter, 1982 and Adger *et al*., 2002). The study has shown that such exploitative strategies were mostly undertaken by poor households, which, in response to the crisis, re-oriented themselves towards subsistence farming, from which they produce only for household consumption, which is often not enough to see them through to the next harvest. Faced with a possible threat to their survival, and acting out of desperation, these farmers started to overexploit accessible resources eitheron- or off-farm, which cause severe degradation (FAO, 2011). Particularly the felling of trees, first on their properties own and then in nearby forests and mountains, was compounded by the lack of

electricity and the unreliable nature of electricity supply in urban centers, giving rise to collecting wood for sale to many who depend on fuelwood. In the context of the case studies, and with specific reference to poor households, it became clear that the Zimbabwean crisis accelerated the application of environmentally destructive land use and to overexploit easily accessible resources for survival purposes. Such activities only provide short-term benefits, such as providing food for the day or a number of days, though the medium- to long-term effects of overexploiting natural resources has negative and devastating consequences, particularly for future generations.

5.3.2.5 Immediate reactions

Following observations by the FAO (2010), some households responded to the situation challenging food availability by reducing the number of meals taken per day or cutting down on preferred foodstuffs. Such reactions are not new: Brüntrup and Heidhues (2002) also confirm similar observations in which household members react by eating low quantities of low-quality food or fewer food items. Although these reactions provide short-term solutions to the food challenge, the medium- to long-term effects are often undesirable: for example, stunted and malnourished children might have long-lasting health and learning problems. In the contexts of the case studies where some people with compromised immune systems live, reductions in food intake might not be the best option, particularly for those on medication that needs to be taken with food. Another immediate response is borrowing from relatives and neighbors, though this is only possible when those other households have something to share. Otherwise in crisis situations people turn to harvesting wild fruits and tree products for a short while. In dire situations of extreme food insecurity, food aid through government handouts or through humanitarian organizations comes in to save lives. Such observations have also been made by Gwenje *et al*. (2015) and Rakotobe *et al*. (2016). In extreme conditions, another common immediate reaction is the disposal of farm assets, especially livestock (Rakotobe *et al*., 2016). This is often done with the hope of replacing them when the situation improves, but this was too risky, particularly for households with fewer assets, as they became poorer than before and failed completely to replace them.

5.3.3 Influencing factors

While several factors were analyzed, the study came up with two important influencing factors, namely farm assets and water. The two factors are discussed in detail below.

5.3.3.1 The role of farm assets

Several empirical pieces of evidence show that the majority of farming households in developing countries suffer from a lack of assets (Asfaw *et al*., 2019; Monjane, 2018; Ngwira *et al*., 2017; Frelat *et al*., 2016). However, in the context of our case studies, and in response to the situation of crisis in the country, the study confirms the important role of farm assets, particularly cattle ownership (Murendo *et al*., 2016). This study shows that households that owned farm assets, particularly cattle, managed to cope effectively with crises in producing not only for their own consumption, but also by intensively producing food and cash crops for the market. Here farm assets played a crucial role, as about two thirds of households (69%) regularly used their own cattle to till their land and used animal manure from their own cattle, resulting in huge savings, which in turn gave them the leverage to buy and use inorganic fertilizers regularly. As a result, households with farm assets were more successful, particularly with the concentration strategy, compared to households with fewer assets. As observed by ODI (1999), farm assets positively influenced farmers during crisis situations to invest in diversified production, as they could easily substitute between assets and activities. Such investments enabled them to respond effectively to emerging market opportunities like the production of high-price vegetables, which were often sold in supermarkets, schools, hospitals and hotels. Consequently, having farm assets presented opportunities even during the peak of the Zimbabwean crisis when well-equipped households became connected to relevant platforms and networks (e.g., tobacco auction floors, milk collection points, the Grain Marketing Board, millers etc.) depending on their produce, which, in turn, enhanced their competitive market advantage. While about 26% of farmers, particularly those who oriented themselves towards the market, were able to build and increase their asset base

during the tobacco-selling season, remittances also played a crucial role in the accumulation of assets during crises, when recipient households invested in their livestock base, set off income shocks and protected their productive asset base. The World Bank (2007) makes similar observations.

However, not all farmers were the same, and the poor and those with few assets struggled to cope with crises, which forced them to re-orient themselves towards subsistence farming and to engage in low-risk and low-return activities (World Bank, 2007). Such activities were mostly exploitative activities which rarely generated enough income to cover the household needs, forcing most such farmers without assets to look for low-paying jobs. These farmers struggled to cope with crises, as the low wages were also insufficient to equip the farm with the necessary assets, while in addition this off-farm engagement dramatically reduced the available workforce, as well as exposing the poor to a vicious cycle of poverty.

5.3.3.2 Water as the key factor

Naturally, in dry conditions, the availability of water sources, whether water reservoirs in the mountains or sources of groundwater, shapes the scope of options available to farmers. Water is a limiting factor of production in large parts of Sub-Saharan Africa, especially given the severe effects of frequent droughts on climate change. In accordance with an observation by Brazier (2017), water availability dictates the kind of livelihoods, distribution and economic activities farmers pursue in response to crises. The changes in rainfall patterns and distribution also affect the recharging of stores of both surface water (streams, rivers, dams, mountain reservoirs) and underground water (wetlands and aquifers). Due to extreme temperatures and frequent droughts, these water stores dry out or fall as the dry season progresses, except for water reservoirs in the mountains. The study provides some empirical evidence of the loss farmers experienced due to climate-related changes in rainfall and water in the context of the case studies, particularly during the drought in 2016, when large losses were incurred by a majority of farming households. Most importantly, however, the study shows that, in some favorable conditions in the context of our case studies regarding where normal and above normal rainfall is received, farmers were able to grow food and cash crops intensively, often with external support that enabled them to actively engage with markets. Also, the availability of water in the mountains influenced farmers, who saw an increase in the establishment of irrigation schemes in drier areas, helping those farmers to modify the growing period for crops in light of the shortened growing period due to climate change, and to farm all year round by rotating crops accordingly. Parallelto irrigation schemes was the adoption of water-saving and moisture-conserving techniques that farmers adopted, such as gravity-fed drip irrigation and mulching, both of which help in saving water,doubling water productivity and increasing yield per unit of water. This in turn helped to increase cropproduction in the face of serious water constraints, as water management problems are solved automatically through the supply of the right amount of water to their crops at the right place and at the right time, especially in the 'intact landscape' case study. The implementation of such a technologymight help improve the livelihoods of farmers in drier areas and promise better yields on smaller piecesof land while conserving the non-productive land and allowing it to regenerate. In spite of the greaterpotential for irrigation to achieve household food security, use of the technology is low in the contextof the case studies in both Zimbabwe and many Sub-Saharan Africa countries. If sufficiently supported,low-cost irrigation schemes can have multiplier benefits for poor farmers, particularly in increasing food security and incomes and in making changes to their well-being. For agro-based economies like Zimbabwe's, the importance of water for agricultural purpose becomes paramount, and investment inirrigation is one way to stabilize the impacts of climate change, especially for farmers located in semi-arid regions. Currently, much of the support for agricultural water provision relies heavily on donors that too are limited in providing support to all farmers, particularly those located in unfavorable areasthat are inaccessible and lack available water sources.

5.3.3.3 Support is crucial

The study demonstrates the ability of farmers to respond to crises in general terms. However, in accordance with the findings of Pannell et al. (2014) and Dekker (2009), we find that the specific scope

and quality of responses vary greatly depending on farmer-specific features, the specific economic and environmental conditions, and the availability and type of external support. This study observed a great deal of support be given to farmers, both external and from within households, despite the many challenges brought about by the crises. Further analysis of the case-study site is dedicated to generating a better understanding of the influence of the diverse external and internal factors on the choice and success of the farmers' strategies. However, it is possible to confirm the observation of Thiede (2014) that it is particularly asset-poor households that suffer from severe constraints in responding effectively to crises. Instead, they tend to stick to relying on activities with low-profit margins (such as wood collection, brick-making, work as casual farm laborers and gold-panning) which are of little help in securing their livelihoods over time. However, the well-equipped households with farm assets during crises managed not only to invest into production for their own consumption, many of them even started to produce cash and food crops intensively for the market. The provision of external support played a critical role for the supported households, though such support was found to be biased towards farmers in favorable situations, such as those with available water and easy access, and those organized into groups, associations and clubs. To an extent this meant leaving behind the neediest communities located in drier, more inaccessible areas, which by virtue of their situations found it extremely difficult to lure external support to their areas. For example, the study found farmers about three villages located in the mountains in 'intact landscape' that were not supported by extension and financial services. Because of the topography and their use of gravity-fed irrigation it was not possible to establish irrigation systems or to draw water upwards, which affected progress and development among these farmers. Coincidentally, there were no water sources above where they lived. Likewise, in the resettlement area case study, two other villages located in mountainous areas were without extension and private company support. Also, the nearness and easy access to commodity markets play an important role because attractive markets strongly stimulate farmer's decisions to invest in or increase the production of commercial crops, such as tobacco in three of our four case studies. However, the focus on commercial production can provoke a decrease in food production for own consumption, which in turn makes farmers vulnerable to price fluctuations, as shown by Maiyaki (2010) for the case of maize, a staple crop for most African countries.

Accordingly, the availability of support for improved water management showed positive results, particularly in producing food. Interestingly, the scope of support changed during the Zimbabwean crisis, from the diffusion of technical packages by governmental agencies towards the promotion of low-cost technologies by development agencies. Doubtless this support has helped to reduce the level of risk among poor communities. The establishment of a cattle bank system for small-scale farms, with a revolving fund supported by both local and international NGOs, helped dairy farmers significantly increase their cattle herds, as well as, more importantly, their milk deliveries to the Milk Collection Centre during the crisis, thereby improving their food and income situations. Also observed was the positive role of contract farming in three case-study sites, which confirms the statement of Scoones et al. (2016) that the private sector can play a positive role enabling small-scale farmers to cope with the crisis by making available credit, inputs, extension support and a guaranteed market. However, in our case studies, 15% in an intact landscape, 12% in small farms, 6% in impoverished landscape and 4% in resettlement areas benefited from external support. Almost 62% of our respondents indicated change by improving their survival strategies through imitation, previous knowledge and learning from others**.**

5.3.3.4 Importance of collectivism vs individualism

As observed by Efendiev and Sorokin (2013) and Pokorny (2013) regarding the importance of collectivism, this study shows that 32% of farmers who belonged to organized groups (dairy association, farmer groups, irrigation groups, nutrition garden groups, internal savings and lending clubs) managed to cope with the Zimbabwean crisis effectively. Through these groups, farmers became stronger in tackling the many challenges, uncertainties and risks presented by the crisis. The study also confirms the observation that social organization has huge potential for sustainable rural economic development (Xu et al., 2013). In the context of the case studies, farmers who organized around the dairy association collectively supported each other to improve milk production in terms of both

quantity and quality, which in turn resulted in higher returns and better lives. They were also able to attract external funding to establish a revolving fund that compensated for the lack of formal loans, as association members could access credit to grow their cattle herds, while they used the returns from milk sales to invest in buying milk utensils, investing in the production of fodder and other dairy requirements. Similarly, farmer, irrigation and nutrition garden groups became stronger by working collectively and also attracted external support, which was often accompanied by input distribution, extension services, training and market linkages. The study thus shows that through collectivism farmers took advantage of emerging opportunities for commercialization and support, as was observed by Pokorny (2013) among Amazonian farmers. This study also illustrates how 32% of Zimbabwean farmers have managed to effectively cope with the impacts of climate change over time by establishing irrigation and garden projects and saving clubs as local credit mechanisms in difficult situations, which gave them some form of social protection (Hu et al., 2007), and collectively identifying and mobilizing rural synergies and leveraging local resources and networks to find solutions to the many challenges. This also helped organized members share and disseminate information and best land-use practices in groups. This resulted in improvements in well-being, food security and the use of sustainable production methods. Such informal institutional systems, when broadened and strengthened, attract local and international support that enhances productivity improvements among socially organized communities and groups.

5.3.3.5 Land tenure as a cornerstone of economic growth and investments

Secure land tenure is a cornerstone of economic growth and acts as an incentive for investment. The study confirms the observations of the FAO (2003) that the freehold tenure rights, in which the landholder has formal rights to the property in the context of one of the case studies of 'small-scale farms', promote sustainable land-use practices and cat as an incentive to invest in the land. Conversely, insecure 'collective' land tenure in the 'impoverished landscape' and leasehold in the 'resettlement area' case studies were linked to poor land use leading to environmental degradation (FAO, 2003). Without security of tenure, households are significantly impaired in their ability to secure sufficient food and enjoy sustainable rural livelihoods. This study therefore shows that secure ownership of land with freehold title improves the incentive to invest, as does the ability to investment in the land. Other empirical evidence reveals similar findings (Sossou and Mbaye, 2018; FAO, 2013). In accordance with the findings of Place and Hazell (1998), who came up with mixed results, this study also shows mixed results in the context of case studies in communal areas with collective tenure rights and in resettlement areas with leasehold tenure rights. Some farmers, irrespective of the insecure tenure arrangements, still went ahead and made some investments, though they did so cautiously, being nowhere near to what farmers with freehold tenure rights can do. In the two communal area case studies there was some continuous investment in manuring and mulching, while in the resettlement area farmers invested in manuring, drilling boreholes to water their vegetable gardens or fields, and additionally installed solar panels and submersible pumps, which resulted in significant yields.

5.4 Lessons learned

There are three specific lessons to be learned from this study concerning respectively the proliferation of crises due to climate change, farmers finding ways to deal with crises, and the importance of support measures in boosting local capacities to deal effectively with crisis situations. The three sections below discuss the lessons learned from this study.

5.4.1 The importance of effective water management in the face of climate change

It became clear during the course of this study that the situation of crisis is aggravating due to climate change. Climate change has already been causing frequent and extreme weather events such as droughts, mid-season dry spells and heatwaves, and is threatening local livelihoods in some semi-arid regions (Brazier, 2017). Zimbabwe in particular and southern Africa in general are hardest hit by climate change due to their geographical position in the semi-arid belt and the reliance of most farmers on rain-fed agriculture. Water is thus a key factor of production, and its effective management is the key to improved production. In line with water-use efficiency, while few farmers apply in-field water-

harvesting techniques, mulching was widely adopted in two of the case studies (community in intact and impoverished landscapes), including in irrigation projects. The latter also use gravity-fed irrigation systems, and only one irrigation group used sprinklers. Without water and with erratic rainfall, the future livelihoods of farmers in semi-arid areas are highly uncertain, which may require them to relocate to better areas. However, without adequate land for a growing population, this might result in conflict and competition over land, and most critical will be the massive exodus of people from drier areas. This might also have serious implications globally, as already experienced at the beginning of 2015, with the massive refugee crisis.

5.4.2 The majority of farmers found ways to deal with crises through combinations of activities

Despite the many challenges farmers faced, the majority of them (75%) were able to find ways to deal with crises. This often involved a combination of on-farm and off-farm activities that enabled households to secure food and raise some income. Those who concentrated their production on the most suitable land parcels were particularly able to guarantee food for their own consumption. Some even started to produce food and cash crops intensively for the market. Well-equipped farmers with farm assets were even able to till their own land and use manure from their cattle, providing themselves with multiple benefits. Farmers had the means to produce basic inexpensive manure to improve soil fertility, which helped them to avoid costly inputs like certified seeds, fertilizers and pesticides. They were also able to diversify their production, concentration and diversification strategies often being linked to markets. This allowed them to increase their incomes from the sale of farm produce by taking advantage of opportunities like high-value vegetable and tobacco production. However, not all farmers were able to find suitable ways of dealing with crises.

5.4.3 Support measures are critical

In the context of the case studies and groups supported by donors, NGOs and private companies, the study shows the importance of providing support to poor farmers inducing them to move from subsistence farming to commercial production. Most importantly, support measures helped to strengthen the stronger farmers, most of whom were members of organized groups, while also tending to leave out the weak. The latter were mostly located in unfavorable areas that are inaccessible, without water and other endowments found in more favorable contexts that received support. In fact, supporting the weak is equally important in enabling them to cope with critical crisis situations.

5.5 Conclusions and recommendations

These findings may indicate a new way of supporting farmers to cope with crises more effectively. It is therefore important to build support strategies aiding the capacities and responses of small-scale farmers, particularly with regard to concentration and both building and strengthening social organizations. Different actors can therefore provide critical support to small-scale farmers to help strengthen the local capacities and responses of small-scale farmers in terms of asset-based development that place emphasis on supporting the local initiatives of small-scale farmers already embraced coping mechanisms to crises.

International cooperation, NGOs and development organizations

Rather than the diffusion of costly technology packages, support should take advantage of and promote farmers' capacity to make meaningful decisions. Thus, support should build on the resources and capacities available at the local level, and accordingly highlight low-cost strategies and efficient water-use management, stimulate financially attractive options for diversification, and further develop existing market opportunities rather than creating new ones. Particularly, the frequently observed strategy of reducing and concentrating inputs on the most suitable land had some positive social and environmental benefits. Supporting such promising attempts by farmers to build robust farming systems in accordance with their capacities and interests can help achieve development, social equality and sustainability in Sub-Saharan Africa. Instead of a 'one solution fits all' approach, support should take into account the regional and individual specifics in order to tailor actions appropriately (Pokorny, 2013; Rockström *et al*., 2004). To operationalize such types of support, however, it will be necessary

to rethink strategies that strengthen farmers' existing capacities. Also, support should not only be provided to farmers in favorable situations, but also to weak farmers in unfavorable situations who are not able to cope with crises. Support must aim to work with what the local farmers have and at a space that is comfortable for them. However, support in livestock provision should not be a priority of international cooperation by NGOs and development organizations because the majority (84%) of farmers already have some livestock in the form of cattle, milk cows or small livestock. Given the shortage of grazing areas in most of these situations, support to cattle rearing would require more grazing land, which may mean more conversion of agricultural land for this purpose. With climate change, however, cattle production is suitable only in favorable situations, as they cannot tolerate much heat or water scarcity.

National governments

To operationalize such an approach requires well-trained extension agents working in well-equipped organizations. Extension services must be tailored to climate, soil, context and markets, and must assist small-scale farmers in adopting sustainable practices and adapting to climate change. Also, the provision of tenure security plays a critical role in motivating farmers to invest in and develop the land, as well as to turn land into a bankable asset that enables farmers to secure bank loans for farm improvements (Matondi and Dekker, 2011). Governments are therefore recommended to create certainty and security of land tenure by issuing land leases to all resettled farmers and to formally recognize and respect collective tenure rights. Equally important is investment in research and development, including in basic infrastructure, particularly the maintenance of public infrastructure such as roads and bridges, which have largely been neglected due to economic hardships. It is important to create and strengthen institutions and regulations that protect and enable small-scale farmers to claim their rights and to protect their resources. It is also important for inputs to be distributed early, before the annual rains, especially as some areas may become inaccessible during the rainy season, providing enough to all deserving farmers, irrespective of their political affiliations. In order to increase productivity, there is a great need to improve agricultural incentives by raising additional money for agriculture that can be used to increase public support (extension services and other support institutions), as well as to improve infrastructure that helps sustain agricultural productivity gains. Government can also assist farmers by providing market facilities for small livestock and small grains, markets for which are still limited. Also, water resources are essential for stabilizing yields, as well as for the intensification of production on farms. Thus, governments can help farmers achieve these benefits through the provision of incentives that encourage more efficient water usage, promote the use of efficient delivery systems and influence the choice of water-efficient crops.

Private sector

The private sector plays and continues to play an important role in supporting farmers through contract farming arrangements. However, it is recommended that it extends its support to the weak farmers as well, who are mostly located far from markets and live and work in unfavorable situations.The private sector must also ensure the replanting of gumtrees by all contracted farmers in order to save forests and trees, which currently are being cut down and used for treating the golden leaf. It is recommended that those who implement gumtree planting and nurturing the plantations receive incentives for doing so and for saving the forests. This will in turn compel other farmers to follow suit.Although over 95% of Zimbabwe's tobacco consist of flue-cured tobacco renowned for its flavor, it is recommended that the private sector should support the growing of tobacco in Zimbabwe, but must also reconsider and introduce other varieties that do not necessarily require use of trees for curing purposes. Similarly, since most farmers complained of low output prices, it is recommended that output prices be consistently reviewed in line with input costs. Apart from tobacco growing, it is also recommended that private companies promote the growing of trees in support of government efforts. Private companies can scale up this process by supporting tree planting two or three times in a year.

Farmers' associations

Farmers' associations should prioritize programs and actions that support the most frequent and common response, namely concentration, as well as market participation and the diversification of production. Farmers' associations can thus help strengthen both strong and weak farmers, particularly with the concentration process, which can help all farmers move from subsistence farming to commercial production. By removing their dependence on government subsidies, farmers can move away from using costly inputs such as fertilizers, certified seeds and pesticides. Through the local sharing of information and knowledge on the concentration process, there is less demand for land in rural areas, as much land is left fallow, allowing for the natural regeneration of shrub and tree species and the creation of new ecosystem services. It is also recommended that farmers' associations provide a training hub where those who have difficulties in accessing extension services may receive information and knowledge through demonstration plots, discussion group meetings and agricultural shows.

Farmers

Given all the difficulties farmers face, it is in their best interests to work collectively rather than individually. It is therefore recommended that farmers be part of an organized group that enables them to obtain information on extension, external support and local credit that is often not available to farmers working individually. But also, farmers with insecure tenure arrangements can lobby and advocate secure tenure arrangements collectively, which can be easier if achieved in large numbers than individually. Given the frequency of droughts and changing climatic conditions, it is recommended that farmers adopt concentration as a response strategy, which promises positive social and environmental benefits, but also removes their dependence on government subsidies for costly inputs. In the same vein, it is recommended that farmers intensify crop–livestock integration with livestock that equips farmers with the means to produce much needed inexpensive animal manure to improve soil fertility. Even when their survival is challenged, it is recommended that farmers consider long-term strategies that bring them benefits while protecting their resource base, rather than short-term strategies that are often destructive of the environment and do not provide them with enough food for their families.

In addition to the above recommendations, in terms of land use, it is recommended that farmers optimize their capacity through diverse forms of intensification on small farms, particularly for the rearing of small livestock such as goats, sheep and chickens, due to their tolerance of dry climatic conditions, low veterinary costs and their ability to utilize pasture through browsing. It is also important for farmers to optimize the use of irrigation resources to stabilize their yields and to intensify their production in irrigation schemes. Most importantly, efficiency in water use is critical to improving farm viability, so farmers must learn to use their scarce resources more efficiently.

In terms of farm size, this study demonstrates that farmers derived reasonable incomes and enough food to feed their families by planting on smaller pieces of land. We therefore argue that the smallest plot sizes are capable of giving high returns, but also that farmers must take care of the need for rotation and fallow periods. In terms of livestock production, it is recommended that farmers on small-scale farms in the resettlement area (A2 model) scale back their cattle herds and rather mix them with small livestock while still being able to obtain reasonable farm returns and provide the manure to improve soil fertility. A combination of small livestock and vegetable farming where water is available should yield more reasonable returns, as demonstrated by nutrition garden groups in the intact landscape case study. However, for dairy production in the small-scale farms case study, where the conditions are favorable to dairying, a revolving fund helps farmers grow large enough herds with milking infrastructure in place. It is therefore recommended that they keep the revolving fund running and thereby benefit all their members as long as they pay back their loans.

The researcher

First, future research ought to address some of the flaws in this study by improving the methodological approach in terms of data collection, as well as acquiring a complete picture of the local reality. In terms of data collection, it is suggested that a balanced representation of stakeholders must be considered, as this helps in providing reliable research data when the planned stakeholders all agree to share the data needed for the study. It is also recommended that more farmers be involved in the research as those who are experiencing crises and that they share their experiences, although this requires more time and resources. The best empirical evidence comes from such informants. Also, acquiring a complete picture of the local reality is of paramount importance, particularly in order to understand the relevance and rationality of farmers' responses in combinations of factors that influence the farmers' decisions that were analyzed in this study. It is therefore recommended that adequate time be spent with communities in order to cover all aspects of the study properly, thereby obtaining a complete picture within a reasonable timeframe. In the same line of thinking, it is also recommended that both structured and unstructured questions be used, the latter in order to acquire in-depth understanding of farmers' emotions and feelings that may also have influenced their decisions and choices. As unstructured questions often require more time, farmers cannot be rushed into sharing these emotions and feelings over short time periods.

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7 ANNEXES

Annex 1. Correlation between independent and dependent variables

	Farm size	Remotns.	Age	Gender	Education	Family size	Farm exper..	Financial situation	Extension services	Financial support	Social organist.
Fincl. sup.											0.2
Ext. serv.										0.6	0.2
Fnancl. sit.									0	0.1	0.1
Farm exper.								-0.1	0	-0.1	0
Family size							0	-0.6	0	-0.1	0
Education						-0.8	0	0.7	0	0.1	0
Gender					0	0	0	0	-0.1	-0.1	0
Age				0.1	0	0	0.7	-0.1	-0.1	-0.1	0
Remotness			-0.1	-0.1	0	0	-0.1	0.1	0.8	0.6	0.2
Farm size		0.1	-0.1	-0.1	0.2	-0.2	0	0.2	0.1	0.2	-0.4
Farm assets	0.4	0	0	0	0.8	-0.6	0	0.6	0	0	-0.1

Annex 2. Interview guide for the expert and group interviews

Purpose: To gain understanding of the crisis and the range of adopted strategies
Questions:

1. What has changed as a result of multiple crisis since year 2000?
2. What were the immediate reactions and strategies to changed conditions?
3. How many meals per day do families eat in times of crisis?
4. Which ways do households use to cope with limited food availability in times of severe crisis?
5. Which food compromising strategies are adopted by what type of households?
6. In such difficult situations, what kind of finance coping strategies do households take?
7. What are the strategic strategies do farmers take in response to crisis?
8. What are the reasons for the chosen strategies?
9. In responding to changed conditions, are farmers working collectively or individually?
10. For those working together, what exactly are they doing, where and for how long?
11. What are the modes and level of interconnectedness among the farmers?
12. What is the level of economic cooperation, trust and intensity of communication among the farmers?
13. Are there differences between farmers working collectively and those working individually?
14. Which farmers are supported, where, by who, and how many?
15. What kind of support is availed to farmers in times of crisis?
16. Production systems: How many farmers producing only food for their families, and or with surplus?
17. How many farmers and producing for markets and where and under what conditions?
18. How further are they from markets?
19. How many farmers are engaged with markets, where and are they supported or self- financing their farming operations?
20. Are farmers adequately served by extension services, research and development services? If yes, how many are adequately served and how many are inadequately served?
21. How many are financing own farming activities?
22. How many farmers are well equipped with farm assets, and how many are not?

Annex 3. Semi-structured interview schedule

Purpose: To find out the specifics of the adopted strategies, rationality, and effects.
Questions:

1. Which strategies did farmers opt for in response to crisis, where and under what conditions?
2. What influenced the household to adopt the chosen strategies?
3. Why did the household prefer the chosen strategies over others?
4. What context specific features promote the adoption of which strategies?
5. For how long has a chosen strategy been practiced?
6. How important and successful has been the chosen strategy?
7. What is the rationale behind the choice of the adopted strategy?
8. What are the effects of the adopted strategies?

Annex 4. Survey with lead-farmers and extension agents

Purpose: To gain knowledge on factors and conditions that hinder or support farmers during crisis
Questions:

Farm assets

1. Which households are with assets, few assets or no assets at all?
2. What kinds of farm assets do farmers have?
3. What farm assets are considered critical by farming households?
4. When farmers do not have key assets or have few, how do they cope with their farming endeavor?
5. What is the difference between households with and those without assets?
6. What strategies have been adopted by farmers with assets, with few and those without assets?

Remoteness

7. How many households are located near markets and far from markets?
8. Which production systems are practiced by farmers near and those further from markets?
9. How many farmers are engaged with markets, where and for what produce?
10. What strategies have been adopted farmers located near markets and those further away?

Farm sizes

11. What the farm sizes owned by surveyed households?
12. How households own small, medium, and or large farms?
13. Which strategies did farmers adopt commensurate with their farm size?
14. In total, how many are doing what, where and under what conditions?

Land tenure

15. What is the land tenure system for each case study?
16. How secure is the tenure system?
17. What is the influence of tenure system on farmers' behavior and choices?
18. How farmers are doing under and which tenure system?

Age

19. How old is the head of the household?
20. Based on their age, which strategies did they adopt in respond to crisis and why?
21. How many of which age group are doing what, where and under what conditions?

Gender

22. How many households have a male or female head?
23. Are there differences in the strategies chosen by different household heads, if yes, why?
24. How many of which household heads are doing what, where and under what conditions?
25. Are there differences in land and asset ownership by gender?
26. Do production levels differ by gender? If yes, how many of which gender are more successful in which strategies?

Education

27. What is the education level of the HH head?
28. How many are well and least educated, where and which strategies did they opt for?
29. How many of which households are doing well and why?

Family size

30. How many members are found per household?
31. How many members of such households have a member living and working outside the farm, where and for how long?
32. How many households with an away family member receive regular remittances?
33. On average, how much do they receive from a migrant member?
34. How many households use family and or have hired or casual labor?

Farm experience

35. How many households have experienced farmers?
36. How many households are new comers into farming business?
37. How many of which farmers are doing what, where and under what conditions?

Financial situation

38. How many households are poor and how many are better-off (rich)?
39. Which strategies are adopted by poor households?
40. What are the strategies for the rich households?
41. How successful are the rich in difficult times?
42. How many of the rich families are part of organized groups and how many of the poor households are working collectively in groups?

Extension services

43. How many household heads have access to extension services?
44. Which household heads often have easy access to extension services?
45. How many extension officer are found per case study?
46. How many households are served by an extension officer?
47. How often do farmers receive advice, information and extension services?
48. How many farmers based on the access to extension services are doing what, where, and under what conditions?

Financial support

49. How many households are receiving or have received external support?
50. Which external organizations are supporting farmers in your area?
51. Which community based organizations are supporting farmers' initiatives in your area?
52. What are the most strategies supported?
53. How much financial support is availed to farmers and for how long?
54. How many farmers are not supported?
55. How are farmers without support coping with crisis? Which strategies did they adopt in response to crisis

Social organization

56. How many household heads are part of an organized group, where and under what conditions?
57. How many farmers are not part of an organized group?
58. What exactly are they doing in those groups?
59. What is the level of connectedness among farmers?
60. What are the levels of economic cooperation, trust, and intensity of communication among the farmers in the case studies?
61. Which strategies were adopted by household heads that are members of an organized group?
62. What strategies did household heads who work individually adopted? Are they successful working alone?

Annex 5. Participatory mapping exercise schedule

Purpose: For experts, local leadership, and representatives of NGOs

Questions:

1. How has crisis changed the conditions under which farmers live?
2. In what way has government assisted farmers?
3. How many farmers have received government support, how often, and where?
4. Who are the other actors?
5. What support has been offered by other actors (International development agencies, local NGOs, CBOs, and Rural Institutions?
6. What strategies did farmers adopt in response to crisis, where and under what conditions?
7. How important and effective are the adopted strategies
8. What are the typical features found in your area which influence farmers' behavior and choices?
9. What is the quality of extension services offered to farmers in your area?
10. What economic and or social networks exist which farmers are part of?
11. Who is working with who and what are the levels of cooperation, trust and communication among farmers?