# ENHANCING CLIMATE RESILIENCE AND FOOD SECURITY IN MUDZI RURAL DISTRICT THROUGH INTEGRATED WATERSHED MANAGEMENT AND CONSERVATION AGRICULTURE

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## ABSTRACT
Agriculture constitutes the cornerstone of Zimbabwe's rural economy, providing sustenance and driving economic activities for most rural populations. However, despite its significance, rural agriculture has increasingly faced multifaceted challenges, including climate change and the failure to implement context-specific improvement strategies, leading to noticeable decline. This decline has caused widespread food insecurity, prompting a surge in donor-assisted food aid programs across rural Zimbabwe since 2016, mostly affecting rural communities that are heavily reliant on agricultural commodities for food, income, employment, and market access. Nevertheless, despite the apparent collapse of rural agriculture, prospects for sustenance and resilience remain alive. This paper argues that tailored approaches such as integrating Watershed Management and Conservation Agriculture can revitalize rural agriculture and bolster food security. By integrating Watershed Management and Conservation agriculture strategies, rural communities can reclaim agriculture as a vital component of their economy and mitigate food insecurity that has been pervasive for years. This paper explored integrating Watershed Management practices into Conservation Agriculture to enhance adaptability, productivity, resilience and food security in rural communities; while providing a strategic response to climate change shocks, especially responding to climate change rainfall disruptions, seasonal changes, crop and livestock diseases and low crop productivity. This article stems from a PhD study, "Towards rural household food security through investment in productive assets (PA): A case of Mudzi Rural District in Zimbabwe", in which the study employed a qualitative methodology, comprising five focus group discussions involving fifty-two community members, field observations, eighteen key informant interviews, thirty-five majorly qualitative questionnaires, literature review, and a case study of Mudzi district. This paper reveals that the two approaches are mutually compatible and integrating them can synergistically assist to transform rural agriculture, bolstering food security and climate resilience in Zimbabwe.

**Key Words:** Watershed Management; Conservation Agriculture; Food Security; Livelihoods

## INTRODUCTION
Over the past ten years, Zimbabwe has been severely affected by extreme climate change shocks which led to poor agricultural production and chronic food insecurity in many parts of zimbabwe (Moyo et al. 2020; Zimbabwe Vulnerability Assessment Committee (ZIMVAC), 2020). Due to harsh climatic conditions, the food security situation in

the rural communities has been extremely unreliable and unsustainable with many families in dire need of food assistance (Moyo et al. 2020). The 2019 ZIMVAC Report states that this has also affected the general development in the least economically developed communities like rural areas. Apart from food insecurity in Zimbabwe, many other countries in the Southern African region have been heavily affected by climate-related shocks, recording relatively slight economic growth over the past two decades (Moyo et al. 2020). This little growth has largely been marred by widespread joblessness, inequality and poverty in both urban and rural communities (African Development Bank et al. 2017). In the face of inequality and poverty, Zimbabwe is said to be one of many African countries that have failed to maximize their potential in agriculture, especially in rural communities (International Labour Organization (ILO), 2017) despite that agriculture is the backbone of the rural food security and overall growth for most African countries. According to the Economic Commission of Africa (ECA) (2012), agricultural economy is essential for poverty reduction and food security in Africa. The ILO (2017) further argued that 54% of the working African population in 2016-17 was under agricultural economy. In Burundi, Burkina Faso and Madagascar, more than 80% of the labor force works in agriculture. In Zimbabwe, the 2020 Zimbabwe Vulnerability Assessment Committee (ZIIMVAC) reported that the performance of the agricultural sector especially in rural areas remains a key determinant of food security or insecurity.

In addition to agriculture being a major employer in Africa, the Southern Africa region including Zimbabwe remains with a vast area of arable uncultivated land, with huge agricultural growth potential (Kanu et al. 2014). However, countries have not yet taken advantage of it. Chanza et al. (2019) argued that despite the undisputed impact of climate change, most African countries have not yet taken advantage of approaches and strategies that help to reduce the impact of climate change and improve productivity amongst rural communities. In this regard, FAO (2015) argues that despite the importance of the agricultural sector, about one-fourth of the population in the Sub-Saharan Africa experiences hunger and food insecurity every year. Also, out of about 795 million people suffering from chronic undernourishment globally, 220 million live in the sub-Saharan Africa (FAO 2015). This population translates into around 23.2% of the chronically undernourished population globally which the Food and Agricultural Organization (FAO) (2015) indicated to be the highest prevalence of undernourishment in a region worldwide. Overall, Africa is a net importer of food which puts additional strain on scarce foreign exchange reserves of many Sub-Saharan region countries, including Zimbabwe. This shows that a mix of strategies are required to curb climate change and support agricultural practices that help especially poor communities to strive in the face of climate change.

In Zimbabwe, many factors have led to the decline of the agricultural productivity, impacting the agricultural economy. FAO (2015) noted that poor conservation techniques in the face of climate shocks has been a major drawback though other factors such as post-harvest losses have been rampant. Chanza et al. (2019) believe that climate change played a massive role in paralyzing the rural agrarian system. Kanu et al. (2014) noted that due to climate disturbances, growing and harvesting seasons have increasingly been unpredictable. In addition, the Sub-Saharan region has one of the most vulnerable agricultures worldwide to extreme weather events, such as drought and floods due to its heavy reliance on rain-fed agriculture, low adaptive capacity and limited infrastructure development (Kanu et al. 2014). However, despite many challenges associated with climate variations and related factors, there is still significant evidence that agriculture will continue to be an integral part of the economy in most developing countries and specifically rural communities (ECA 2012). The Africa Research Institute (2017) challenged Africa to adopt rural agriculture-based approaches and technologies to help rural communities adapt to new climatic conditions and become more productive. Gwaka (2019) noted that previous studies have shown that the Sub-Saharan Africa's opportunities to revive rural agriculture and improve food security may rise from the possibility of tapping into tailor made solutions, this position provides hope in integrating approaches such as the watershed-based approach and conservation agriculture. FAO (2009) noted that most African countries including Zimbabwe, have not yet invested significantly in tailor-made approaches to sustain rural agriculture for food security. This may mean that integrating the Watershed Management approach and Conservation Agriculture could be a viable option for Africa to support rural agriculture and livelihoods during this era of climate change uncertainty.

## SUMMARY OF THE PAPER

This paper comprises eight sections. Following this introduction is a brief literature review and discussion on the Watershed Management and Conservation Agriculture approaches. This will be followed by an outline of the research methodology that was used by the paper. After methodology, there will be a section divided into study findings (results) and then discussion. The last three sections include recommendations, with possible future research areas, conclusion and reference list.

## THE WATERSHED MANAGEMENT APPROACH

The integrated watershed management approach forms the foundation of this article. It paved the way for the understanding and adoption of processes for formulating and implementing courses of action that supports land tenure, land and water use, management of natural and human resources and adoption of agricultural activities that consider the social, political, economic, and institutional factors operating within a community and its resources for the achievement

of social objectives (Dixon and Easter 1991). Having been evolving for a very long time in terms of definition, scope, and application (Wang et al. 2016; Bebermeier et al. 2017, and Roth et al. 2016), the latest edition to the concept of the Watershed Management Approach has been used in this paper. According (Dixon and Easter 1991), Integrated watershed management has been defined as the procedure of formulating and implementing sequences of activities or action involving natural and human resources in a community area defined as a drainage basin. The formulation and implementation of sequences of activities is done with a full recognition of critical factors such as the social, political, economic, and institutional factors operating within the community or drainage basin, to meet specific objectives such as environmental protection, boosting local agricultural initiatives, land healing and conserving new and existing livelihood assets (Wang et al. 2016; WFP 2017).

Tennyson (2005) noted that the application of the holistic approach of the watershed management allows different actors to protect and restore the physical, chemical, and biological integrity of ecosystems whilst giving an allowance to trying new methods of land utilization or farming as well as new livelihoods activities to preserve human health and the base for sustainable economic growth. Because people, land and other resources and systems interconnect in a drainage basin (a community), the need for their protection and sustenance through tailor-made activities has been identified as critical for the revival of rural agriculture and the subsequent fight for food security (USA National Research Council, 1999). This approach was adopted by World Food Programme (WFP) and the Mudzi community when they implemented the Productive Assets concept (2017-2023) in Mudzi rural district, thus forming the case study for this article.

The Watershed Approach under the WFP and Mudzi Rural Community's Food Assistance for Assets (FFA)/Productive Assets programme has been used to develop community assets aimed at boosting rural agricultural production. Using food and cash-based transfers as a medium for conducting programme activities, WFP (2017) argued that the approach is a representation of one of the modern-day approaches being adopted by the humanitarian community to assist rural communities in addressing and chronic food security challenges due to climate change shocks. The programme facilitated the development of community asserts based on a watershed approach model (that supported improved agricultural activities and utilization of livelihoods assets (World Food Programme 2016). The model focused on watershed-based assets and their impact on people and the whole community as a conditionality placed on communities so that food assistance is not provided as a free handout (WFP 2017). Broadly, the watershed-based approach reflected an appreciation of the diversity of livelihoods of rural people despite climate change impact that has affected rural rain-fed agriculture. It also showed that communities have roles to play through different types of assets (for livelihoods) implemented within the wider social, environmental, political and economic environment whilst mediating access to their assets (Reardon, Taylor et al. 2000).

The watershed approach in Mudzi Rural District created water harvesting assets like weir dams and an assortment of other assets and activities around these water assets. The communities constructed dip tanks, nutrition gardens, fishponds, fruit orchards and other small livestock projects around the water sources. The weir dams would act as the key watershed assets that attract other related assets and activities to further protect the whole area that the asset is situated in. Following the creation of these assets, several watershed management activities would be implemented to protect the assets and provide further value to the environment (environmental protection) as complementary activities to the watershed approach. The philosophy behind the adoption of the approach in Mudzi Rural District was that the community would benefit from the established assets whilst taking care of the same assets and its environment (which is the watershed), hence an assortment of conservation works that were also supported by the various local leaders and government technical departments. The assets were identified by the communities themselves, for example those areas they could have previously tried to harvest water from but failed to do so due to lack of resources, the Mudzi Rural District Council would also validate these through Council actions plans.

According to Browner (1996), the watershed approach is a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically defined geographic areas, taking into consideration both ground and surface water flow. In this regard, according to WFP (2017), Mudzi Rural District communities were involved in constructing gabions, water percolation holes, drainage basins, wire or natural gabions, live fencing, stone buns and others. This was in addition to the goal of the watershed approach to sustain community livelihoods through rural agricultural transformation leading to food security.

According to Wang et al. (2017), watershed approaches may vary in terms of specific objectives, priorities, elements, timing, and resources. In this regard, the variations in the approach are guided by principles such as partnerships, geographic focus, and sound management techniques. For partnerships, the people most affected by community decisions must be involved throughout and shape key decisions for the activities that are planned and conducted to ensure that community development objectives and environmental objectives are well integrated with those for economic stability and other social and cultural goals. In Mudzi, the weir dams, nutrition gardens and other project's activities within the watershed were guided by a joint planning process involving the local authority, World Food Programme, World Vision, the affected communities and government technical departments. For geographic focus, activities are directed within specific geographic areas, for example areas with needy and have spaces suitable to

construct the assets, areas that drain surface water bodies or that recharge or overlay ground waters or a combination of both. In terms of Sound Management Techniques, Wang et al. (2017) argued that Science and Data are useful in construction of different assets e.g., weir dams. According to WFP (2019) this also involve sites approvals and drawings for weir dams, making sure that the activities meet minimum standards, and the materials are of high quality, durable and develop strong assets. According to the District Development Coordinator of Mudzi Rural District (2021), government departments' role is to ensure that structures for assets are within the required standards and allow communities to have capacity to manage them on their own which is critical to maintain durability and sustainability.

## CONSERVATION AGRICULTURE

In the face of increased pressure from climate change, Conservation Agriculture (CA) has been on a rise in Zimbabwe, especially in rural subsistence agricultural practices. According to FAO (2016), CA is a farming method that aims to increase crop yields while conserving soil, water, and nutrients. It has a farming method that resembles some key attributes of the Watershed Management approach in more than one way. According to WFP (2020), CA has increasingly been promoted in Zimbabwe, with Nyamangara et al. (2014) arguing that CA has been promoted in Zimbabwe since 2004 and is now practiced amongst more than 300,000 farmers in rural communities. According to Mpala (2020), Conservation agriculture has been part of smart agriculture for a long time, helping rural communities across Zimbabwe to fight against climate change induced rainfall variations, boosting food security, and helping communities to conserve farming/arable lands. Moyo et al. (2020) argued that farmers who adopted Conservation agriculture along the way have been able to boost field production, some recording more than two tons of maize per hectare. Moyo et al. also argued that some of the farmers were able surpass their harvests when they were using conservation agriculture methods. Accordingly, these methods have been said to conserve farmland more than conventional methods, as there is less land disturbance, less use of fertilizers but more use of organic manure in the fields.

Chanza et al. (2019) believe CA has been a huge cog in assisting economic recovery in Zimbabwe, as the farming approach helped Zimbabwe's economy recover from a decade-long recession that saw a sharp drop in agricultural production between 1985 and 2005. Nyamangara et al (2014) argue that CA helps to deal with climate change, conservation of the natural environment and farming lands, thus helping to mitigate the adverse effects of climate change because the approach includes practices such as agroforestry, zero tillage, alley cropping, integrated pest management, organic farming, crop and pasture rotation, and contour farming. According to FAO (2016), the government of Zimbabwe supports conservation agriculture through the National Conservation Agriculture Task Force, with the FAO also having worked with the government to promote conservation agriculture through training, demonstrations, and the introduction of mechanical planters.

There are several similarities between the watershed approach and conservation agriculture. The two approaches have shown the importance in proffering solutions to a variety of problems facing communities (climate change impacts, food insecurity, tailored agricultural approaches challenges and others). In this regard, many communities that have applied the two concepts have seen improvements in agricultural activities and productivity (Browner, 1996; Mpala, 2020). Substantial reductions have been achieved in environmental degradation, an improvement on the usage of natural resources for food production, especially activities that sustainably utilize a combination of land and water resources (Browner 1996). These successes have been achieved primarily by allowing people to know their environment, understand that their food, livelihoods and life depends on the land resources available to them and their ability to remain viable and cope with increasing populations and climatic pressures. However, apart from the successes, it is critical to note that while the land and its resources remain important for people's food security, activities that extract benefits from the environments continue to be environmental threats, hence most of the success was based on an assortment of a lot of protection activities that aid the environment to be sustainable. This means that the approaches must be understood wholesomely, and that they are not a solution without effort and being adapted to other contextual factors. Both approaches are based on establishing environmental objectives that help to guide activities towards solving high priority problems and providing real community improvements rather than simply doing things because there is a national or local blueprint or programme that they must fulfil.

## METHODS AND PROCESSES

This paper has been qualitatively driven using a case study of Mudzi Rural District in Zimbabwe. The article has been derived from data collected for a PhD study titled: "Towards rural household food security through investment in productive assets (PA): A case of Mudzi Rural District in Zimbabwe" which was conducted in wards 6, 7, 15 and 18 of Mudzi Rural District. The researchers employed an interpretivism research philosophy (Lincoln, 2000; Denzin, 1994) and qualitative approach, comprising five focus group discussions involving fifty-two community members, field observations, eighteen key informant interviews, thirty-five majorly qualitative questionnaires, and literature review. The researchers investigated the key characteristics of Watershed Management practices and Conservation Agriculture and analyzed the potential impact of integrating the two approaches. The use of a case study allowed the researchers to get a deep understanding of the evolution that took place in Mudzi rural agriculture in the face of climate change and massive food insecurity; and explored the role and value of the watershed management and conservation agriculture

approaches in rural agricultural transformation for the purposes of food security. This also enabled study participants to contribute their wide-ranging understanding and experience in participating in watershed management and conservation agricultural interventions and activities to the research.

# RESULTS AND DISCUSSION

## STUDY RESULTS

This section provides the major findings, highlighting the results that the researchers felt are key to present in this paper.

## CHARACTERISTICS OF WATERSHED-BASED AND CONSERVATION AGRICULTURE-BASED ACTIVITIES IN MUDZI RURAL DISTRICT.

This theme was derived from the need to establish the similarities between Watershed-based and Conservation Agriculture-based activities. The paper found out that about 89% of the participant responses indicated that the bulk of watershed management activities were closely linked to the activities that are conducted under Conservation Agriculture approach, this is despite that the watershed activities were more detailed, structured and measured, including data and information from a variety of technical people and departments. The study established that CA has not yet been considered a technical component of agriculture, therefore, communities tend not to seriously view CA as a game changer in the face of food insecurity, revitalizing agriculture and climate change due to the amount of detail and coaching they have received from the government if compared to the learning they had on the watershed management activities. However, based on participant experience in Mudzi Rural District, there were key characteristics that are similar in form and meaning on both the two approaches, which the paper argues that these make it easier to integrate the two approaches. Below are the main characteristics that the paper picked, and they are also presented as sub-themes:

## SUSTAINABLE LAND USE WITHIN ARABLE LANDS

The most talked about characteristic was “sustainable land use”, with over 95% of the participants discussing this distinctive endeavor as their number one characteristic of both the watershed management activities and conservation agriculture. The participants in field argued that the two approaches are about conducting agriculture while sustaining the pieces of land available for agriculture purposes. They argued that the approaches are about dealing with land resources management, identifying sustainable land use practices, to increase agriculture production whilst protecting the farming areas. In this, the paper established that there are distinctive activities that can be done within a community, and these depend on whether the area is upstream (farming areas) or downstream (grazing areas/where streams flow to) where different activities to protect the land, water harvesting assets such as weir dams and the surrounding compatible assets such as nutrition gardens, fishponds, fruit tree orchards, beehives and are conducted, thereby increasing opportunities for rural livelihood and food security. The participants indicated that the availability of water through watershed management activities (establishment and management of water sources) open up avenues and further agricultural activities throughout the year, cultivating food crops in nutrition gardens, farming plots all year round as well as utilize those pieces of land that are not always used to plant fruit trees or conduct activities that help them to have viable livelihoods, for example having fishponds and small enterprises such as mushroom production around the weir dam. This allows them to implement mixed actions that resemble both watershed and conservation agriculture models. Most importantly, all the actions provide spaces for many households in the community to produce various types of cereals, leaf vegetables, fruit vegetables, legumes, root vegetables and others which are crucial for food security.

This paper established from more than 70% of participants that sustainable land use lies in knowing that the land itself needs to be taken care of against bad agricultural practices which is a common theme on both Watershed Management and Conservation Agriculture. This includes making sure that all activities adhere to best practices to conserve the natural land and embark on activities that do not harm the land. Participants indicated that they engaged in a lot of land healing activities that enable clean and usable water to be captured infield through land percolation pits, in the weir dams, protecting the land from issues of erosion, degradation and issues of unnecessary cutting down of trees within their communities. The activities are done in all areas around fields and the assets, hence community members with farming fields/plots around the water sources or wetlands would need to put into practice all the protective works so that their fields cannot affect the water assets in the watershed area. Below are the activities that the paper established from participants as part of the work done to make sure that land use conforms to sustainable practices and all the activities fit into the Watershed Management and Conservation Agriculture models.

**Table 1: Best Practises for Sustainable Land Use**

| Activity | Upstream | Down Stream | Fields Around | Impact of Activity |
|---|---|---|---|---|
| Soil Buns | √ | √ | √ | To reduce siltation of the weirs and all sources in the watershed |
| Terracing | √ | - | - | Block debris movement & reduce upstream flowing water velocity |
| Gabion Blocks | √ | √ | √ | Reduce erosion, debris movement, water flow & asset protection |
| Tree planting | √ | √ | - | Reforestation and food production through fruit trees |
| Land Protection | - | - | √ | Farm/plot protection for less damage and improved production |
| Contour bunding | √ | √ | √ | Reduce erosion, debris movement, water flow & asset protection |
| Percolation Pits | √ | - | √ | Improved infiltration and water retention, soil moisture retention |
| ***KEY**: **Upstream** = area before the water asset, area that harvest water for the community*<br>***Fields Around** = All agricultural fields within the watershed*<br>***Downstream** = area after the water asset and fields along the flow of the water* | | | | |

**Source:** *Field Work Discussions and Interviews with study participants*

## LOCAL AREA ANALYSIS TO ESTABLISH THE WATERSHEDS AND CONSERVATION AGRICULTURE ACTIVITIES

More than 90% of the participants indicated that local area analysis to establish the Watersheds and Conservation Agriculture activities has been key in identifying where to construct different water assets such as weir dams, and how to go about implementing protection works. Key to area analysis is what were called, *"transact walks"* which involve key community members who understand their areas. Transact walks were more pronounced in Watershed Management discussion more than in Conservation Agriculture model as the community understands the two. However, this paper argues that the analysis is a key characteristic of the two approaches, though on one model, it's a group activity whilst on CA, it's a household activity, with the purpose remaining the same. The paper established that transact walks are conducted through all corners of the identified watershed areas, or (for CA) the whole household farm, to record every detail of the area, such that the sites for different activities, including establishment of water harvesting assets, implementation of protection works, gardens, fishponds and other related assets that are constructed around the water assets are identified. Also, transact walks identify where protection works need to be initiated and the type of activities that need to be conducted as well as other dimensional and field details such as the nearest fields, how many tributaries feed into the water assets, if there are wetlands and others. These provide key information for planning and implementation of watershed activities and conservation agriculture.

According to key government officials, the call for area analysis is very critical as it allows for comprehensive understanding of both the fields, community as a whole and ensure that technology applied to any work become economically viable, socially acceptable and ecologically sustainable. The positive thing about the watershed management programme in Mudzi Rural District has been reflected in increase in the number of beneficiaries adopting their own transact walks to analyse their fields and come up with the different soil and water conservation measures which characterize watershed-based agricultural activities. However, participants indicated that similar activities are also conducted under the CA, though they are not as formal and well-arranged as those that are done under the Watershed Approach. But, the study established that despite the different ways of conducting area analysis, the key issues remain of understanding community fields (watershed area), and engage in protection works prior to seasonal agricultural activities in the fields; implementing activities such as contour bunding, construction of earthen bunds, terracing, zero tillage for conservation farming and mulching.

## WATER HARVESTING TECHNIQUES AND SOIL CONSERVATION

The paper established that, for many years, Mudzi district has been grappling with perennial water problems. Almost every participant indicated that this challenge affected their agricultural activities since they rely on rain-fed agriculture. Because of this problem, study participants indicated that one of the major factors or characteristics that helped them to accept the watershed approach more like the Conservation Agriculture approach is the broad objective of developing water harvesting assets such as weir dams, earth dams, percolation pits and others, with these allowing the Mudzi community to conduct several agricultural activities and as well develop other livelihood assets around a water source. With climate change, rainfall has not been consistent, there were many droughts, or flash floods which were not ideal

for successful agricultural seasons. In this regard, the participants argued that the idea of harvesting water in whatever way has more than one benefit. They indicated that though the Watershed approach had a distinctive pattern of focusing on community wide water harvesting assets, while the CA concentrate more on infield water harvesting techniques, both approaches solved one of their major challenges, that is the challenge of water for agricultural activities and for domestic uses.

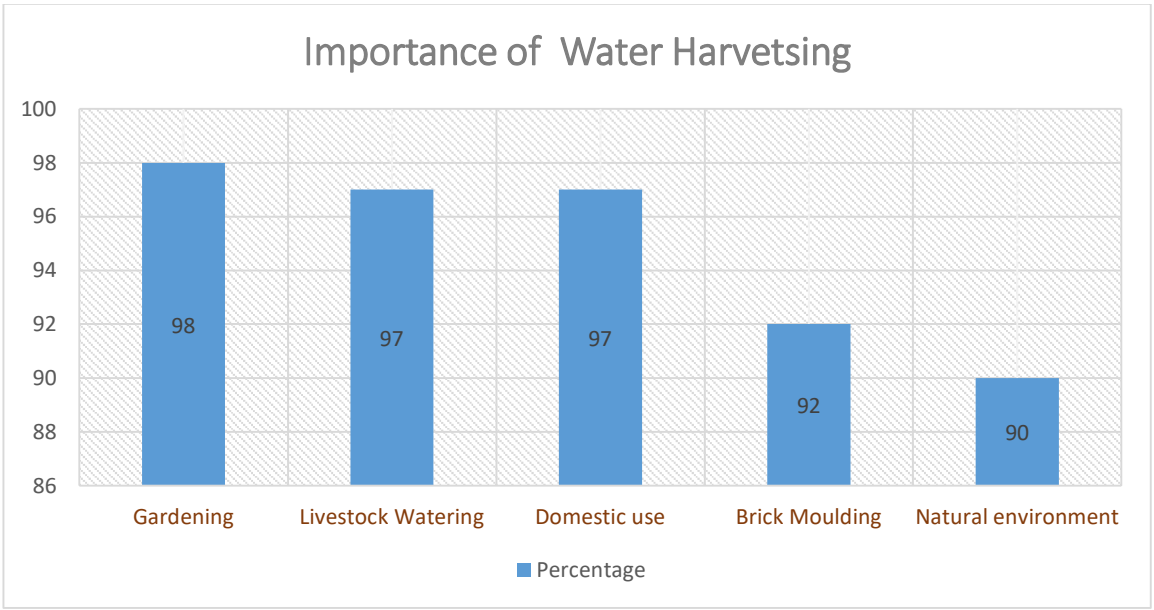
The assets such as community weir or earth dams (gravity dams/weirs and earth dams) are constructed from concrete/stone and earth respectively and designed to hold back large volumes of water. The water-harvesting techniques like rain pitting, infield percolation pits, digging and renovation of wells have been instrumental in raising the depth of water table in the watershed areas, in farms and grazing areas which is key to dealing with consequences of climate change in Mudzi Rural District. Reservoirs created by these structures are used through mechanized agricultural technologies that suit the rural set up for irrigation in the nutrition gardens, fruit tree orchards, human and livestock water consumption and aquaculture. According to one village head in ward 7 of Mudzi Rural District;

> *The availability of water has helped us in a big way, we are now able to conduct agricultural activities throughout the year. Community members can use water from weir dams, deep wells, percolation pits and other earth water assets that we have been taught to construct. Livestock has enough drinking water, and we can cultivate different crops for food and even for selling.*

Despite that the two approaches are not the same when it comes to the emphasis given per activity, the different scale on each activity and the organization of the approach, this paper established that their focus of harvesting water is almost the same, hence, integrating them may provide increased benefits to the rural communities. Below are some of the major benefits of prioritizing water harvesting under the two approaches as has been established by this paper.

**Figure 1: Major Benefits of Water Harvesting under the Watershed Approach and the CA Model**

As is indicated in figure 1 below, water harvesting has been crucial for agricultural activities in Mudzi Rural District, and this has enabled them to enjoy their agricultural activities throughout the year. Gardening is the major agricultural activity for both food production and other economic activities like selling extra produce. The availability of water was also a boost on livestock watering, domestic activities, brick molding and the natural environment has remained productive due to the available moisture from the water assets. Though these benefits seem to reflect much on the Watershed Management approach, the paper established that there are many benefits of water percolation pits, improved water holding basins, ridges and other protection activities that conducted under the CA concept.



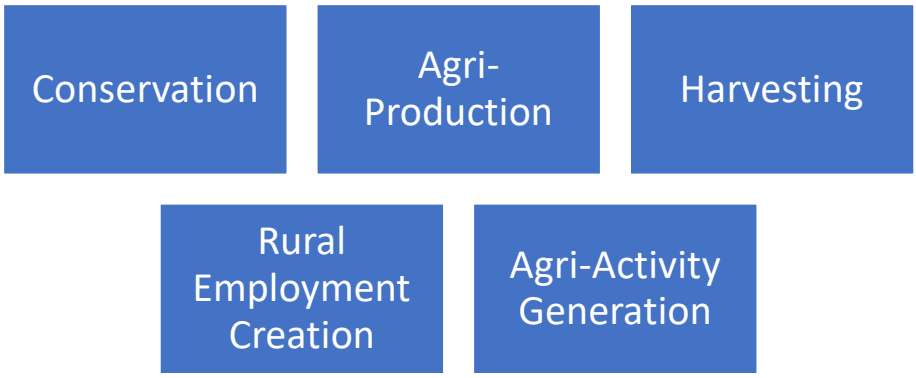

**Source:** *Field Interviews and Discussions with Study Participants*

Study participants noted that these are more significant in field activities, where soil moisture is kept, and soil erosion is reduced. Accordingly, a combination of these benefits adds to a variety of economic activities that are stimulated by the availability water in whatever way in Mudzi district. Mudzi district is located in region 4 and 5 of the Agro-Ecological regions of Zimbabwe, which is generally a dry region, and usually receives less than 650mm of rainfall per year. Regardless of the dry climate, community members depend on rain-fed agriculture as the main livelihood, hence having increased water harvesting techniques has been a welcome development for the communities that participated in this study.

## CONTRIBUTION OF THE WATERSHED APPROACH AND CONSERVATION AGRICULTURE TO AGRICULTURAL SUPPORT AND ACHIEVEMENT OF FOOD SECURITY

The objective of this theme was to further establish the possibility of integrating the Watershed approach and the Conservation Agriculture model by looking at the contribution of the two approaches to agricultural support and achievement of food security. In this regard, this paper established that the two approaches appear to similarly provide the same contribution, especially as they support a variety of agricultural activities leading to more food for community and household consumption and for selling. Below in figure 2, key contributions of the two approaches were established populated based on the field responses to give an insight into how the approaches support agricultural revival and food security.

**Figure 2: Key Contribution to Agricultural Transformation and Food Security Activities**




**Source:** *Field Responses through Interviews, Discussions and Questionnaires*

## CONSERVATION – OF FARMLANDS, PLOTS, WATER AND LIVELIHOOD ASSETS, AND THE NATURAL ENVIRONMENT

Just as has been observed above, this paper established that one key activity that assisted to improve agriculture and the food situation in Mudzi district was combining all activities with land protection works, thus putting conservation at the core of every activity. According to the District Development Coordinator of Mudzi Rural District

> *Agriculture in our rural communities is about conserving the land and water resources which are the source of life and revenue in the district. If there are many programs that emphasize protection of the land and its resources, our agriculture can thrive even in the face of climate change. Our communities can be resilient.*

In this regard, this paper established that, sustainable use of land depends on the community's capacity to organize themselves to manage, operate and maintain the infrastructure and to protect their community (including watersheds, fields, assets, and the environment). Without prioritizing conservation, which is at the heart of Watershed Management and Conservation Agriculture, most water sources silt up and at the end fail to provide adequate water for the different agricultural activities, home use and livestock. The paper noted that conservation means thinking beyond the infrastructure, farm or wetland. Study participants indicated that they have learnt that water is harvested and best practices to conserve it are applied to sustainably use the water. When there is water, communities can water their crops and conduct their domestic activities and as well their livestock are able to access drinking water and stay health. All these are supported by the two approaches.

## AGRI-PRODUCTIVITY ENHANCEMENT

According to the study participants, the availability of water resources has been making agricultural productivity possible throughout the year. Production has been made possible through the secured gardens, water assets for annual activities, infield water harvesting, and the imitation of garden activities and practices to the fields, including the application of decomposed manure which is a critical component of the Conservation Agriculture. In this regard, the gardens and the watershed become the learning platform where farmers imitate the lessons in their individual fields. The study established the importance of demonstration plots in the gardens and at the dam sites where demonstrations of new farming initiatives and techniques to the communities and the beneficiaries of the assets are conducted to improve agricultural production. The demo plots are treated as learning classrooms where communities benefit on various trainings on good farming practices. In addition, through both watershed and conservation agriculture activities there is increase in crop productivity because of various factors like increased human labour-use, rise in manure application and increased soil moisture retention which have been translated into reasonable farm income in nominal as well as real terms.

## HARVESTING - WATER RESOURCES FOR AGRICULTURAL ACTIVITIES

This has been established as one of the chief benefits of both the watershed approach and Conservation Agriculture in Mudzi Rural District, with more than 97% of the study participants showing their appreciation of having water harvesting assets and techniques. As indicated above, Mudzi district is dry and the availability of water through water harvesting techniques has allowed them to venture into perennial agricultural activities to produce food and even have other products to sell in the district markets. The paper established that water-harvesting techniques like rain pitting, percolation pits, ridging, digging, weir dams and renovated wells have been instrumental in raising the depth of water table in the watershed area. All these strategies and techniques directly contribute towards a significant rise in the levels of water resources within the community, indicating a positive impact on the moisture regime and groundwater recharge, which all have influenced positively on several agricultural activities and on agricultural production in Mudzi district. Table 2 below shows the major agricultural activities that were boosted by the availability of water resources.

**Table 2: Agricultural Activities in the Watershed Approach**

| Activity | Upstream | Down Stream | Fields Around | Impact of Activity or Sub-Activities for Impact |
|---|---|---|---|---|
| Gardening | - | √ | - | Leafy, root, bulb, legume, fruit vegetable production all year-round |
| Fish Production | - | √ | √ | Small-managed fishponds, drawing water from the weirs |
| Fruit Trees Orchards | √ | √ | √ | Variety of fruit trees, which act also as protective shields |
| Livestock Watering | - | √ | √ | Large livestock drinking water, enhanced grazing and browsing |
| Mushroom Projects | - | √ | √ | Mushroom agriculture, supported by available water |
| Field Crop Production | √ | √ | √ | Food crops in the garden and the fields around the water source |
| Small Livestock | - | √ | √ | Small livestock watering, fowl and bird projects with water available |
| ***KEY***: ***Up-Stream*** *= area before the water asset, area that harvest water for the community*<br>***Fields Around*** *= All agricultural fields within the watershed*<br>***Down-Stream*** *= area after the water asset and fields along the flow of the water* | | | | |

**Source:** *Field Responses through Interviews, Discussions and Questionnaires*

## RURAL EMPLOYMENT CREATION – THROUGH ALL YEAR-ROUND AGRICULTURAL ACTIVITIES

This paper established that because of both the watershed management activities and Conservation Agriculture, there has been increased crop production, productivity, farm income and ultimately increased rural employment creation, which all came into existence because everyone has had something to do throughout the year. This means that there was employment creation through activities from both models, though still the watershed management approach is credited with the bulk of employment opportunities, with people working in the gardens, to manage livestock, working in fishponds, fruit tree orchards and other activities around water assets. The most revealing aspect about all the activities, according to study participants is that, they all lead to increased crop production and as well the incorporation of best practices with the participation of both community members, government departments and key stakeholders in the district. With everyone having something to do, this paper established that there was a significant increase in overall crop production per year in the four wards where the study was conducted, with Suswe and Chimukoko (wards 6 and 7) becoming the major producers for cereals and other vegetables, leading to overall stable food situation in those two wards.

## GENERATION - OF AGRICULTURAL ACTIVITIES BASED ON THE MANAGEMENT OF UPSTREAM AND DOWNSTREAM RESOURCES

The paper discovered that both watershed management and conservation agriculture generate tailored agricultural activities that suit the context of the rural communities. Study participants indicated that this is important as it encourages everyone to have something to do, even during the off-rain season. The activities range from gardening with manageable plots, fruit tree orchards, bee keeping, fish production through small fishponds, livestock production and other agricultural activities that produce food for the families and excess for selling. The study established that the two approaches assisted communities to understand that agricultural activities can be done throughout the year by generating activities that contribute towards the conservation of as much precipitation as possible in the soil profile and collection, storage and reuse of harvested water. Water has been noted as an important part of a collection of activities that are generated as part of agricultural activities. One field participant argued that;

*Livelihood activities are now no longer based on dry land farming but are now diversified due to the mix of strategies from the Watershed approach and Conservation Agriculture. Income generation is now all year round. Most households are now food secure through proper and continuous utilization of their pieces of irrigated land and adoption of best agricultural practices.*

## DISCUSSION

This paper argues that despite the differences in approach and organization, the two approaches (Watershed management and Conservation Agriculture) have common similarities that makes it not difficult to integrate them for the benefit of rural agriculture. They all contribute to the revival of rural agriculture in several ways. The approaches in Mudzi district have seen most farmers harvesting more than their household consumption requirements and have remained with surplus for selling. Adoption of conservation agriculture as part of watershed approaches assisted environmentally sound production techniques. The environment is spared from degradation while levels of production are enhanced thereby improving community and household food security. Undertaking water harvesting, soil, and water conservation techniques through mechanical conservation structures mentioned earlier on improves crop performance.

The watershed approach has been seen to be complemented well by selection of appropriate crop varieties coupled with timely planting, proper spacing for good crop cover to the soil, weeding and timeous manure application (conservation agriculture), and pest control have seen Mudzi Rural Community improves food availability. Planting of fodder grasses and trees upland has preserved soil as well as established soil conservation and water harvesting structures. Terracing has been one such practise that has significantly contributed to better agricultural practices in Mudzi Rural District when undertaken holistically with other techniques from Conservation Agriculture. In this regard, this paper strongly argues that the two approaches can complement each other and more benefits can be realized if they can be integrated.

As has been indicated in the literature review, a combination of the combining the efforts of the community, government and other partners in implementing the two approaches could also be an avenue for bridging the differences that exist between the two approaches. It is also crucial to point out that the two approaches have their weaknesses which may need to be studied exclusively to derive full benefits of integrating them. This may include the unavailability of a distinct approach to the Conservation Agriculture approach and the need to document it for the purposes of further developing it. Also, the need to make Conservation Agriculture adaptable to sound management techniques just as good as how these apply to the Watershed Management approach is crucial.

## RECOMMENDATIONS AND POSSIBLE FUTURE RESEARCH AREAS

Despite many positive reviews of the two approaches, it is of paramount importance for the two approaches to have adapted models to the Zimbabwean context, and especially, the rural context. This will make it easier to integrate the two approaches. There is still a lot of work that needs to be done to make them suit all people in different rural contexts. Also, it is crucial to note that the bulk of the work that is done under the approaches remain heavy duty, which therefore requires the work to be fused with relevant technologies to reduce the burdens of heavy-duty work. Also, the study argues that intense pieces of training must be mandatory for people to understand and successfully implement the two approaches worse still the integrated offspring. In this regard, key steps and research areas going forward may include the following:

- Educating the communities continuously on the Watershed-based and Conservation Agriculture approaches, clearly portraying the steps, processes and benefits and envision an integrated version of the two.
- Capacity building for the technical government departments for them to disseminate information on the two models and offer support to community members.
- Timely input support to rural communities at subsidized prices on whatever requires additional cost.
- Create platforms for communities to be involved in planning and throughout all phases of the approaches. Allow communities to exercise ownership, operation and maintenance of the approaches so that they can operationalize them on their own.
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This paper recommends that widespread willingness to participate in the two approaches by rural communities is the starting point to sustainability and resilience when individuals realize the importance of the concepts. This must be through demonstrations at household, village, ward and district level activities, promotions and competitions that could also attractively rewards uptake as an incentive of adopting the approaches. To instill further acceptance and adoption of the concepts, there is need to educate farmers for mindset change so that they appreciate the approaches together with the appropriate technologies that are part of the approaches. Innovation must be carefully taught for it be accepted, whether it means slowly but surely, making sure that no one is left out. To further motivate and encourage adoption, provision of approach starter packs to lead farmers in the community could present remarkable initiatives in meeting the requirements of each approach. Lead farmers and those willing to take initiative would also need to fully engage and utilize the knowledge and education with support from government ministries and departments.

## CONCLUSION

The paper investigated the potential of integrating the Watershed Management and Conservation Agriculture approaches. By engaging participants in Mudzi Rural district, the paper established encouraging trends where the watershed approach has been supported by activities of the Conservation Approach, which means that the two approaches can be integrated. The two approaches have been strengthened by a variety of filed protection works that enabled projects to be initiated on traditionally unsuitable sites such as steep slopes, signaling improvements in land use. With protection works on the environment, there were also possibilities of turning rejected pieces of land into functional agricultural spaces for communities that are also close to water sources. Despite the detailed scope of work that communities engaged in under the watershed management approach, it is no doubt that most of the activities are closely linked to Conservation Agriculture. In this regard, this paper concludes that, the two approaches are closely linked, and their integration may provide a single guide for communities to engage in sustainable agriculture that is tailored to current challenges such as climate change and food insecurity. Activities that extract benefits from land will continue to be an environmental threat; and therefore, potential causes of land impairment must be addressed under both approaches such that land remains a viable source of development and food security despite the ever-changing nature of human activities. Despite that climate variations leading to climate change continue to threaten agriculture, human activities and local laws may threaten sustainability and productivity. In this regard this paper has concluded that there are potential possibilities that may be offered by integrating the watershed-based approach and CA to bring together all competing factors in a subsistence environment for the benefit of the marginalized person, especially the benefits allied to environmental sustainability, agricultural practice improvements, intensification and transformation of rural agriculture and food security. More can be explored using the tailored approaches while recognizing the existence of the legal, economic, social and political barriers to the development and administration of rural agricultural and land systems. This means that integrating the two approaches could constitute a viable option to boost food security in the face of climate change shocks within rural communities. The integration of the Watershed Management approach and Conservation Agriculture offers promising opportunities for rural communities to harness the benefits of taking care of their land and supporting land-based agricultural activities within their watersheds, while mainstreaming climate change mitigation into agricultural practices for enhanced production and food security.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.