

# ADDUNET

An ACP-EU Technology-Transfer Network on Rainwater Harvesting  
Irrigation Management for Sustainable Dryland Agriculture, Food  
Security and Poverty Alleviation in sub-Saharan Africa



## Technology Transfer Network on Rainwater Harvesting

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# About AFRHINET

AFRHINET is a three-year project which focuses on fostering the knowledge and use of rainwater harvesting technologies for supplemental irrigation in rural drylands of sub-Saharan Africa. The project focuses on the implementation of integrated capacity-building activities, the development of research and technology-transfer centres, and the setting-up of a transnational network of multivariate relevant actors. The action of the

project takes place in Ethiopia, Kenya, Mozambique and Zimbabwe.

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# CAPACITY NEEDS POTENTIAL AND MARKET ORIENTED PRODUCTS -

## Zimbabwe

BY

MENAS WUTA AND GEORGE NYAMADZAWO

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# Introduction

- Zimbabwe's climate exhibits high variations in rainfall from region to region and from year to year.
- Only 37 percent of the country receives adequate rainfall for agriculture.
- For the rest of the country the rainfall pattern is insufficient, erratic and unreliable making supplementary or full-time irrigation indispensable for successful agriculture (FAO, 2005).
- Due to the high variations of rainfall in the country, rainwater harvesting and irrigation becomes very critical to the sustainability of small holder farming in Zimbabwe.



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# Introduction

- Long dry spells and droughts experienced during the rainy season often leads to very low yields and in some areas total crop failure especially in Natural regions IV and V and some parts of region III (Figure 1) where mean annual rainfall is below 500 mm per annum.
- Researchers have reported an increase in the area in Natural regions IV and V and have attributed this to climate change and variability (Mugandani *et al.*, 2012) further underlining the need for use of RWHI technologies
- Climate change models have projected a decrease in rainfall in southern Africa (New et al. 2006), and research has already shown the same trends (Nyagumbo et al. 2009a).



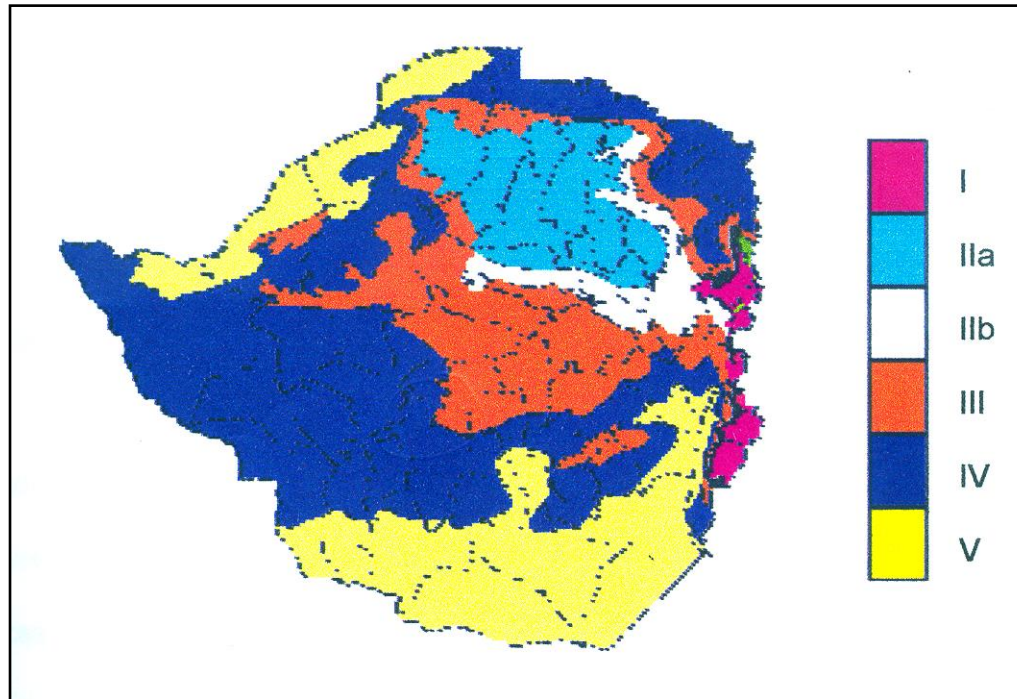
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# Introduction - Agro-ecological (Natural Regions) of Zimbabwe



Natural Region	Area (km <sup>2</sup> )	Rainfall (mm yr <sup>-1</sup> )
I	7 000	>1 000
II	58 600	750 – 1 000
III	72 900	650 - 800
IV	147 800	450 - 650
V	104 400	<450

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# Introduction

- The declining of rainfall, which is already inadequate for about 63% of the farming areas in Zimbabwe, poses a serious threat to the sustainability of small scale farming.
- It is therefore imperative for all stakeholders to ensure that mitigation measures, such as RWHI and the development of drought resilient crops with shorter maturity periods, are put in place.



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# Examples of existing technologies

## Smallholder irrigation schemes

- Most schemes set up by government
- Source of water are rivers and boreholes
- Irrigation method – flood/sprinkler
- Some of the schemes need rehabilitation

## Drip kits

- Mainly promoted by NGOs, private companies (for horticulture), and Department of Irrigation
- Source of water – streams/rivers and wells
- Challenge
  - Failure in uptake after NGOs projects end
  - Moving of water into raised storage containers (drums)



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## Drip Kits - Drip kit abandoned, Masvingo District.



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# Examples of existing technologies

## Water harvesting from bare rocks

- Water collected in small dams, but serious evaporation losses
- Other farmers have developed sub-surface/underground small storage dams to avoid losses
- Water moved by gravity to fields

## Shallow storage dams/wells

- Especially in wetlands
- For irrigating wetland gardens
  - Cans/buckets used for irrigation
  - In some cases by gravity using pvc pipes
  - A few farmers use small diesel/petrol pumps



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# Examples of existing technologies

## In-field water harvesting technologies

- Mainly promoted by NGOs
- Technologies include Dead level contours (DLCs), Infiltration pits



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# Analysis of political and institutional framework

- In Zimbabwe, the political and institutional framework for RWHI interventions for smallholder farmers draw together a number of stakeholders with different roles, responsibilities and interests.
- The government, through various ministries and departments owns and control both surface and groundwater resources.
- However, there is very little control on the water which is harvested in small reservoirs because RWH is mainly done on a small-scale or at household level.



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# Analysis of political and institutional framework

## •Ministry of Agriculture and Mechanisation and Irrigation

- Department of Irrigation (DOI)
  - » Involved in both the small- and large-scale irrigation sectors
  - » Mainly do the planning, design and implementation of irrigation schemes
- Department of Research and Extension Services (AREX)
  - » Responsible for the provision of extension services to small-scale farmers on matters related irrigation and agricultural production



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# Analysis of political and institutional framework

## •The Ministry of Environment, Water and Climate

- Zimbabwe National Water Authority (ZINWA)
  - Responsible for the costing, allocation and the distribution of water.
  - Regulator in the water sector, and in charge of major dams and all water resources
- Department of Water Development (DWD)
  - In charge of the overall formulation of national policies and standards for the planning, management and development of the nation's water resources.
- Environmental Management Agency (EMA)
  - Monitors and enforces water quality standards to prevent pollution of water bodies, wetlands & land



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# Analysis of political and institutional framework

- **Ministry of Transport and Infrastructural Development**
  - District Development Fund (DDF)
    - Responsible for the development of rural infrastructure such as roads, small dams and boreholes at district level
- **Ministry of Local Government, Public Works and National Housing**
  - Rural District Councils
    - Lead in mobilising local communities, farmer selection and irrigation plot allocation in smallholder irrigation development
- **Ministry of Finance and Economic Development**
  - Avails resources and funding for development activities such as irrigation schemes and construction of dams



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## Assessment of Research and Innovation needs

- Research on RWH in smallholder areas has focused on in-field (in-situ) water harvesting, especially in the drier parts of the country.
- This was because researchers believed that in-situ RWH showed a greater likelihood of success (Motsi et al., 2004, Mupangwa, et al., 2006, Mutekwa and Kusangaya, 2006 and Munamati and Nyagumbo, 2012).
- Biophysical conditions (Terrain) – determines the appropriate RWHI technologies to employ
  - e.g. Bare rocks – provides surface for water harvesting
  - Nearby river – possibly sites for sand dams
- Small scale farmers without access to these land features have resorted to in-field water harvesting technologies, such as dead level contours (DLCs). Research needs to come up with RWHI technologies to assist these farmers.



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## Assessment of Research and Innovation needs

- Suitable, efficient water conveyancing systems from harvested water to the field including pumping systems need to be developed.
- Solar power seems to be the best bet but costs are still limiting farmers.
- In Zimbabwe there are possibilities of some companies assembling solar panels with assistance from a European company. It is hoped that prices will come down significantly.
- Water quality needs to be tested. Researchers have observed that some of the water harvested from roof surfaces have high coliforms (Gwenzi *et al.*, 2015)



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# Assessment of Research and Innovation needs

- A few farmers have developed underground water reservoirs for irrigation, however, the efficiency of such systems have not been evaluated for different environmental conditions e.g. soil textures, slope, rainfall etc.
- There is need to assess and evaluate suitable water storage systems made using locally available material while working closely with farmers and come up with technical guidelines.
- Technical guidelines must be in both English and vernacular languages



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# Analysis of capacities and training needs in RWHI

- Generally it has been observed that curricula in universities and agricultural colleges include the component of irrigation with a bias towards large scale commercial irrigation.
- RWHI is given very little attention and yet has great potential in semi-arid and arid regions of the Zimbabwe.
- There is therefore need for curriculum review to include small scale RWHI.
- Extension officers need short courses in RWHI so as to give research informed advice to farmers.
- Knowledge sharing platforms are required for farmers to appreciate the various technological innovations available.



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# Analysis of technology-transfer and market-oriented needs

Currently technological transfer is very poor in Zimbabwe because of several reasons:

- Lack of consultations between researchers, NGOs, equipment traders and farmers on appropriate irrigation equipment
- Lack of interaction between farmers and technical advisers has resulted in poor technology transfer. Farmers are not sufficiently part of the process of choosing the technology suited to their circumstances, especially when schemes are being developed or rehabilitated.
- In addition, technical advisers lack skills, commitment and back-up to interact meaningfully with the farmers.



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## Analysis of technology-transfer and market-oriented needs

- Also, many farmers have no irrigation experience or have had inadequate exposure to technologies to debate the options.
- In addition, most of the traders do not do market research to determine the appropriate products, they do not provide back-up services and spares. This has resulted in farmers refusing to adopt some technologies.
- Some of the irrigation equipment is costly and the pricing is above the reach of many farmers. For example, currently in Zimbabwe, the cheapest solar pumping unit costs US\$2500.
- Even though the solar pumping system is a sustainable option for irrigation, the initial investment is very high and is well above the reach of many small-scale farmers in Zimbabwe, making it difficult to adopt the technology.



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# Analysis of technology-transfer and market-oriented needs

- Farmers adopt technologies because of the incentives given to them by NGOs and other institutions, but as soon as the support is removed at the end of the project, farmers abandon the technology.
- There is therefore need to work closely with farmers so that farmer driven technologies are identified, developed and promoted.



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# SUMMARY

## Perceptions

- In some communities, RWH techniques are perceived to be for the poor and some stigma exists around the application of these techniques.
- *Historically in Zimbabwe, the use of contour ridges was resisted by farmers, as it was seen as a tool of oppression because of the brute force used to enforce the law and the high labour demand required for the construction of the contours (Dreyer, 1997)*
- Lack of proper education for small scale irrigators on the benefits of using RWHI techniques may affect the uptake of the techniques by farmers. Most of the techniques are labour intensive and need to be redone every year and farmers may view this as too much of a burden (Nyamadzawo *et al.*, 2013).



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# SUMMARY

## Institutional framework

- Efforts in RWH are currently fragmented, NGOs, Government departments, research institutions are doing their own things.
- Policy in the country on RWHI mainly focuses on large and complex infrastructure such as dams but does not provide guidelines for technologies applied at lower levels such as small scale irrigators.
- RWHI should be integrated in the extension services provided by government in a broader way that incorporates other techniques apart from contour ridges.
- Extension workers therefore need to be trained in RWHI. Curricula at Agricultural colleges should incorporate this.



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# SUMMARY

## Design of RWHI facilities

- One of the challenges of the application of RWHI techniques by small scale farmers was the assumption that the same techniques would work the same way in different regions.
- Lack of technical standards for RWHI techniques is a major challenge and therefore research should help in over-coming this challenge.



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# SUMMARY

## Sustainability

- Most of the programs have failed to continue after the NGOs or the Government stopped providing inputs.
- From the available literature, the major challenges of all the technologies still remain high labour intensity and at times blanket recommendations of interventions for farmers without their input (Munamati and Nyagumbo, 2010).



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