



AGRO-ECOLOGY AND WATER HARVESTING IN ZIMBABWE



Location: Zvishavane, Zimbabwe

Since the late 1960s, Zephaniah Phiri Maseko has pioneered a unique, innovative vision for community and agricultural development through judicious water management; his system has been widely adopted across the country, increasing agricultural productivity and resilience in this semi-arid region.

CHALLENGE

British colonial rule and the white Rhodesian Government made Zimbabwe one of the world's most inequitable countries. The Land Apportionment Act of 1930 gave white settlers control of more than 51 percent of the country's land, leaving areas less fertile and more arid to the native population. Despite the land reform implemented in the early 2000s, most black farmers still farm small plots of infertile land, with limited irrigation potential.

Maize is Zimbabwe's staple crop. It is grown mainly through rain-fed agriculture, making it highly vulnerable to droughts, which are increasingly problematic. Only three droughts were recorded by the country's Agricultural, Technical and Extension Services (AGRITEX) between 1911 and 1970. Between 1971 and 2000, the number increased to seven, and between 2001 and 2009, seven droughts were recorded in just nine years.¹ At the same time, most farmers experienced decreased yields even when there was good rainfall because of decreased soil fertility and increased reliance upon agrochemicals and hybrid seed.

The government's agricultural extension services have struggled to assist farmers. Early successes with systems integrating cropping and livestock have not been replicated due to rigid land use frameworks, which have not evolved since the 1930s. After independence, efforts to extend fertilizer and marketing services yielded remarkable success in the higher potential areas, but subsidies eventually proved unsustainable through the era of structural adjustment. Cash crops like cotton and sunflowers—promoted in collaboration with the private sector render farmers vulnerable to unstable market prices and dependent on costly inputs. Extension packages provided by the government are also deficient, as they vary little by soil type, rainfall regime, and other local agro-ecological and cultural realities. Finally, many international NGOs have been promoting conservation agriculture (CA) models, but these innovations typically do not persist beyond the period of heavy extension and subsidization, especially because like the government's fertilizer recommendations they do not vary across different soil and rainfall zones.

In this challenging environment, a remarkably innovative and determined peasant farmer has realized great innovations. Following detention and black-listing for employment during the independence struggle, Zephaniah Phiri Maseko was restricted to his poor land parcel in 1966. Mr. Phiri has since transformed a typical three hectare family landholding in Zvishavane District into an internationally renowned oasis. His land sits at the foot of a large, exposed granite dome and his small fields comprise soils ranging from loose structureless sand to heavy clays; soil moisture levels vary alarmingly from place to place and throughout the brief rainy and long dry seasons. The average annual rainfall in Zvishavane is 450 mm,² but during droughts, there can be just 250 mm of rain. Periodically, heavy rains erode and leach the soil, causing flood damage. Even when rainfall comes in the right range, most of it falls in a few massive storms and quickly flows off the land and/or

remains at the soil surface, quickly evaporating in the hot sunny days that follow. Phiri has determined how to transform the amount of water available to crops, reaping enormous benefits for decades.

RESPONSE³ Water Harvesting

Phiri's success first began with nearly four decades of innovative research on his own land, but was also fostered by enabling other farmers to adapt successes to their own agro-ecological conditions and by facilitating a visiting and networking system that allows farmer-to-farmer extension at almost no cost.

Phiri's water harvesting approach has two key principles:

1. Slow down water movement—thereby maximizing erosion control and infiltration—to ensure that every drop of rainfall is fully utilized

- In the 1960s, Phiri started exploring how to sink wells in the wetter areas of his land and use the groundwater for supplementary irrigation. In the 1970s he developed a new tactic to stop water from leaving his land during periods of heavy rainfall, which consisted of building deep pond-like dams in his wetland and using the excavated clay and termite mounds to make a sealed dam wall, blocking the water flowing from the bare granite crest to the valley below.
- In the 1980s, Phiri constructed dozens of stone walls, earth bunds, sand traps, run-off dams and ditches around his homestead and along the boundary of the bare granite. This enabled better water infiltration into the soils and gentler down-slope flow of water into the field region below to avoid erosion.
- Through the end of the 1980s and 1990s, Phiri constructed pits above the contour ridge and down the fields, increasing the lowest pits into large oblongs capable of holding the increasingly substantial amounts of water available.

2. Manage water in the wetland

The natural wetlands or “makuvi,” as they are locally known, provide rich grazing areas, excellent well sites, and productive farming areas during the wet and dry seasons.

- The pond-like dams built in the 1970s make water available for agricultural and non-agricultural use but also separate it from the soil itself, which prevent water logging of prime areas and consequent loss of workability and fertility. Thus, ponds increase crop yields in wet years as well as in dry years.
- Surrounding the ponds with shade trees, reeds, and banana groves keeps them cool and sheltered and reduces evaporation.
- Phiri constructed canals and ditches to release stored pond water in the fields; some are lined with clay, others with brick and cement. Some canals worked by gravity, using overflow from the ponds; others are started with simple pumps. Half a dozen field areas with an area of about two acres (one hectare) could once be irrigated in this fashion, depending on need and availability. Innovations Phiri

Figure 1: Water management innovations on the Zvishavane farm

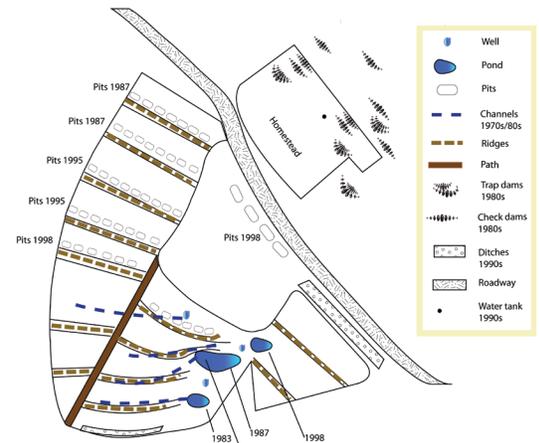


Figure 2: Direction of water flows in the fields

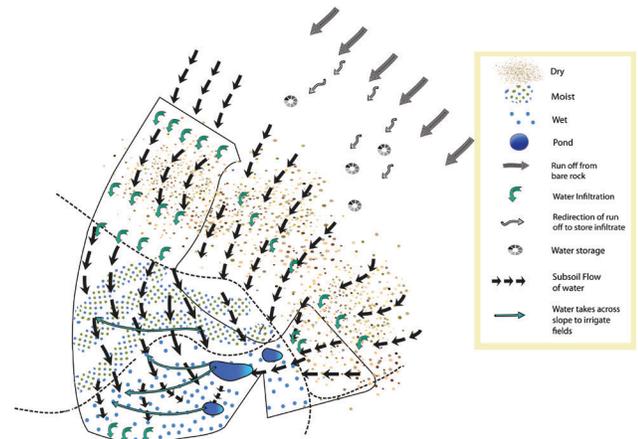
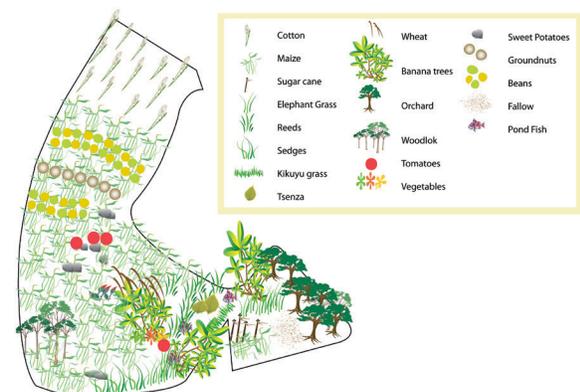


Figure 3: Diversity of crops cultivated on Mr. Phiri's land



developed in the 2000s to enable gravity to redistribute water across the land have now rendered the first canals obsolete.

Managing Soils for Water and Clay Content

- Phiri has studied the heterogeneity of his soils and manages them according to their clay and moisture content. The most intensive agriculture is sustained on the clay-rich, true wetland soils, often with perennial crops. To make these clay soils manageable--in the past they alternated between waterlogged and rock-hard--they have been transformed into springy loams with an irregular surface, built up with cattle manure and extensive mulching with green manure and crop residues. This sustains fertility, avoids nutrient loss through water-logging, limits evaporation, and reduces erosion risk.
- In areas with water flow risk, erosion is prevented through complete plant cover—such as Kikuyu grass. In sandier areas where soil can hold neither moisture nor nutrients, Phiri increases the clay content with cartloads of termite mound soil and clay dug out of his man-made ponds.

Planting and Maintaining both Indigenous and Exotic Tree Species

Phiri believes trees are central to maintaining ecological health. A 1999 survey of his homestead plot—52 m by 80 m at its widest point—found 149 trees. There were 41 species, including both exotic and indigenous fruit or non-fruit tree species. A 2010 follow-up survey found 175 trees of 55 species, a 25 percent increase in just ten years. Mr. Phiri exalts biodiversity and celebrates the huge bird population that lives and nests on his land, and the frogs, and everything else that love the permanent water.

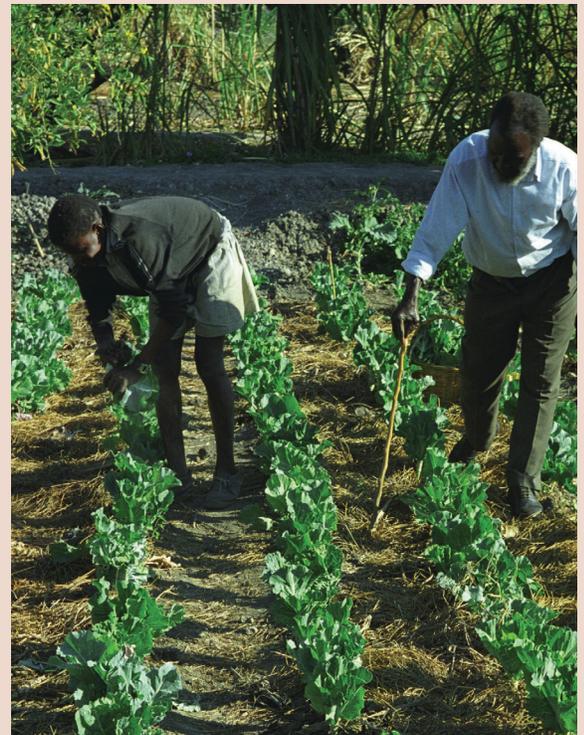
Inter-Cropping, Crop Rotation, Integrating Legumes, and Establishing Perennials

Phiri practices a wide diversity of crop rotations tailored to meet the different soil-water conditions and to help manage weeds, pests and diseases. He frequently integrates legumes—groundnuts, roundnuts, beans, and cowpeas—and even wild legumes to sustain soil nitrogen levels. Maize remains the dominant crop both for food and sale, but Phiri also grows other cereals such as sorghum, rice and even wheat. He also has cotton and sunflowers as well as sweet potatoes, and a wide variety of vegetables. In the 2009-2010 season there were 55 crops grown on his farm, not including indigenous fruit trees, indigenous semi-cultivars, or different varieties of the same crop.

Phiri argues that farming systems need to “rhyme with nature” if they are to be sustainable, hence his emphasis on diversity. Unlike most farmers in the region who rely only on annuals that grow rapidly during the brief rain periods, Phiri focuses on perennials, or at least multi-year species like bananas, reeds, bamboo, sugar cane and yams. Perennials have various benefits: with deep and extensive roots, they can access water and nutrients at a deeper level. The roots also have a stabilizing effect, tying up the soil and preventing surface erosion by wind and water. As the roots slow down water runoff, they can help manage streams and avoid dry or flash flood situations.

“Sure, it’s a slow process, but that’s life. Slowly implement these projects, and as you begin to rhyme with nature, soon other lives will start to rhyme with yours.”

– Zephania Phiri Maseko



Irrigated vegetables. © Ken Wilson

“Water is like blood—it is always attracted to the wound. Gullies are wounds. Blood goes to the wound to coagulate and heal it. It does this with gabions and swales where the gully is filled with fertile soil.”

– Zephania Phiri Maseko

Farm Diversity and Integration

Phiri experiments with a huge variety of indigenous and exotic crops and emphasizes unusual crops such as tree cassavas, which have edible leaves. Basket weavers have purchased the reeds he grows, providing him with income during difficult drought periods.

Phiri's livestock rely heavily on field crop residues and also consume the hand cut grasses that sustain the contours and drainage lines. This system enables him to keep a larger number of animals than would be possible if he relied on communal grazing and to protect its cattle during drought. In turn, livestock manure sustains the fields' fertility, and animals provide the extensive draught inputs required for plowing, cultivating, harrowing, and transporting harvests, soil and other items.

RESULTS⁴

Phiri's approach to agriculture has transformed his productivity and resilience. The wide diversity of crops, livestock and other products provides him with a steady and resilient income through the vicissitudes of economic and ecological crisis, cycle and change. He has become very resilient to droughts, for he is putting far more water into the soil than he takes out. With only a primary education, Phiri has been celebrated by national and international specialists and, in 2010, he was honored with a Lifetime Achievement Award from the University of Zimbabwe.

Perhaps most importantly, Phiri has found ways to share his work with other farmers. In 1987, he created the Zvishavane Water Project (ZWP), one of the earliest indigenous NGOs in the country, to help communities acquire skills and build and maintain dozens of small dams, wells and water tank systems across the region. Phiri also served as a mediator; travelling to schools to teach the teachers and students how to harvest the rainfall.

Phiri officially retired in 1996, granting ZWP—which continues to work on a wide range of water, garden and health projects across Southern Zimbabwe—the use of a portion of his land as an income generating and demonstration plot. Over 8,000 people formally visited his farm between 1990 and 2010. A process of farmer-to-farmer extension, facilitated by locally-grounded NGOs and agricultural extension workers, has been quietly underway across the country since the 1990s. Mr. Phiri is clearly having a national impact. Leaders of many

organizations attest that thousands farmers are now using these approaches, adapting them to their own landscapes and integrating them with other ideas about sustainability, and transforming local markets and food sovereignty. The so-called crisis in Zimbabwe has actually opened a lot of space for farmer-led innovation at the local level.

In places like Chikukwa in the Eastern Highlands, farmers and their local institutions have taken Phiri-style thinking and applied it over nearly two decades to farming systems with steep slopes and much higher rainfall.⁵ In neighbouring Mazvihwa, a 2010 survey found that about one third of farmers were digging “Phiri pits” to encourage infiltration. These pits are one to two meters deep and there may be dozens or hundreds in a field complex; they represent major labor investments. Although a similar expansion happened in parts of Chivi in the 1990s,⁶ changes in Mazvihwa were much more systemic in that they involved widespread well sinking (about a quarter of Mazvihwa's farmers), pond-making (around ten percent of farmers) and the remaking of the once-hated colonial contour ridges in ways that would hold (rather than shed) storm water (around a quarter of all farmers). This degree of indigenous innovation flowed from experiences with Mr. Phiri over twenty years earlier when he had worked as an action researcher there. Likewise skills they had learned with his Zvishavane Water Projects meant that small dams could now be built at the community catchment level—beyond the individual farmer—without any external support. In Mazvihwa this spontaneous adoption and adaption of Mr. Phiri's holistic approach became facilitated by a local community-based NGO called Muonde Trust, which focused on facilitating farmer-to-farmer extension and in particular on enabling practitioners to improve outcomes by sharing knowledge, measuring and surveying results for themselves.⁷ In 2014, Muonde's village extension workers pegged with field owners an incredible 468 dead-level contours whose estimated length could take them to Harare and back (800 km), most of which is now dug, often to the depth of a meter or more. Participants have also completed 58 ponds, 634 sand traps and healed dozens of gullies. In the face of continued erratic rainfall, the transformation underway in Mazvihwa well represents how farmer innovation can transform underlying constraints instead of tinkering with seed-fertilizer-tillage combinations, a top down solution still widely promoted by governments, international organizations and NGOs.

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ENDNOTES

- 1 Nkayi Office of the District Agricultural and Extension Office (AGRITEX), April 2010.
- 2 Jerie, S. and P. Mugiya. "The Effectiveness of Basin Tillage on Maize Production in the Semi-Arid Dayataya Ward of Southern Zimbabwe." *Journal of Sustainable Development in Africa*, 12.4 (2010) 28:40.
- 3 A large part of this section is adapted from, Wilson, Ken. *A Lifetime's Record of Innovation and Experimentation: Mr. Phiri's Water, Soil and Landscape Management Principles as Exemplified on His Own Land*. <http://www.muonde.org/wp-content/uploads/2013/12/CH2Mr-PhiriEcologyFarm.pdf> (accessed July 6, 2015).
- 4 Lancaster, Brad. *Rainwater Harvesting for Drylands and Beyond*. Tucson: Rainsource Press, 2006.
- 5 The Permaculture Research Institute. "The Chikukwa Permaculture Project (Zimbabwe) – The Full Story." <http://permaculturenews.org/2013/08/15/the-chikukwa-permaculture-project-zimbabwe-the-full-story/> (accessed July 6, 2015).
- 6 Kuda Murwira *et al.* *Beating Hunger: the Chivi Experience: community-based approach to food security in Zimbabwe*. ITDG, 2000.
- 7 Muonde Trust & friends. *Supporting Indigenous Innovations in Mazvihwa, Zimbabwe*. www.muonde.org (accessed July 6, 2015).

FRONT PAGE PHOTO:

Mr. Phiri harvesting sugar cane. © Ken Wilson