Factors Influencing the Awareness and Adoption of Borehole-Garden Permaculture in Malawi

Lessons for the promotion of Sustainable Practices

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Background

Malawi

A largely agrarian state
80% of the population is reliant on rain-fed, small-holder agriculture (National Planning Commission Malawi, 2020)

High levels of poverty
50.7% of the population living below the poverty line (IMF 2017)

Heavily relaint on groundwater
Over 100,000 water-points such as boreholes, hand-dug wells, and surface water (Kalin et al., 2019)

Dysfunctional waterpoints
~50% of waterpoints are partially functional or non-functional (Kalin et al., 2019)

Challenges due to climate change
Climate change will only exacerbate the pressure on water supplies (Hall et al., 2021)
Malawi loses ~1.7% of its GDP each year to losses from droughts and flooding

Borehole-garden permaculture

Borehole-garden permaculture proposes that stagnant water accumulating around boreholes is channelled into community-managed gardens providing a low cost and sustainable method of irrigation for community gardens.

Key benefits

Removal of stagnant water
The removal of stagnant water provides public health benefits as stagnant water which acts as key breeding grounds for the malaria transmitting *Anopheles* mosquitoes and other water-borne diseases

Generation of year-round food
Enabling diets to be supplemented, thereby tackling food insecurity and increasing nutrition

Provide income to fund borehole maintainance
Rivett (2018) proposed that funds generated from BGP could sufficiently coverthe costs of borehole maintenance to prevent the waterpoint becoming dysfunctional.

Research questions

What is the extent of borehole-garden permaculture awareness and adoption in Malawi?

Do the analysed variables influence borehole-garden permaculture awareness and adoption?

What lessons for the future promotion of borehole-garden permaculture can be learnt from where communities are aware of or adopt BGP?

Figure 1: Example borehole-permaculture garden. Stagnant water from the borehole is channelled to a community garden at the end of a soakaway. Photo supplied by Gift Wanangwa.

Materials and methods

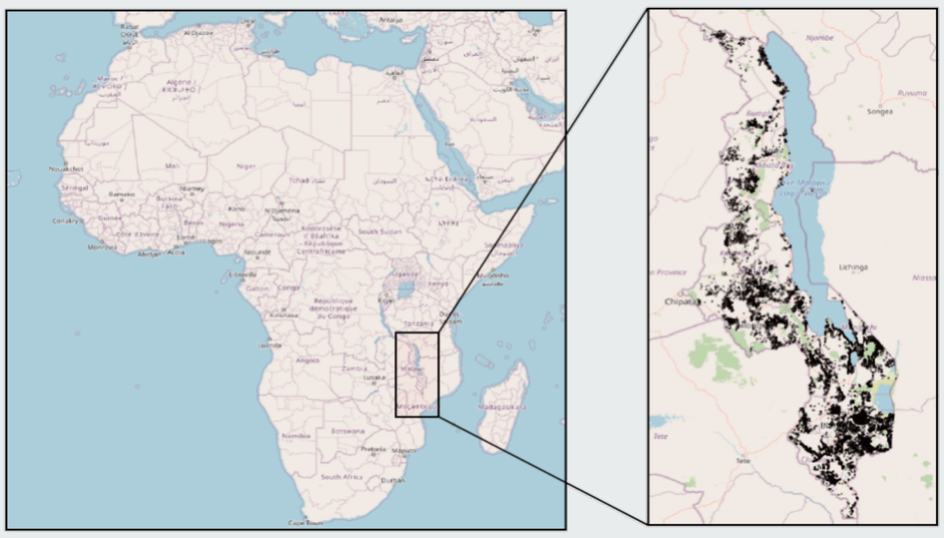


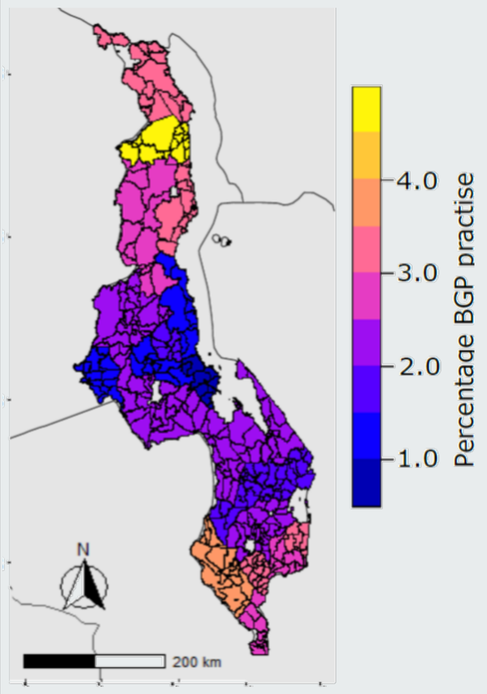
Figure 2: Map of Malawi with the point locations of water-points analysed in this study.

Data relating to over 100,000 water points across Malawi was collected between 2012-2021 by the Government of Malawi through the Climate Justice Fund.
Waterpoints were systematically visited by trained staff and surveys were conducted in Englishor Chichewa. Data was then quality controlled at the University of Strathclyde.

Variables for investigation were selected based on literature regarding sustainable technique adoption. 3 categories of variables were selected: socioeconomic, biophysical and waterpoint specific variables. Data regarding the values of variables across Malawi was accessed through from open-source databases including datasets from the Regional Centre For Mapping Of Resources For Development (RCMRD) and SERVIR-Eastern and Southern Africa.

Following data cleaning, 75,013 boreholes were analysed using generalised linear models (using the GLM function in base R) to identify factors influencing where borehole-garden permaculture had been heard of. Forward variable selection was used to provide a model with the simplest explanation.

Results



43.0% of surveyed water-points in Malawi were aware of borehole-garden permaculture (32,256)
2.4% of waterpoints were practising borehole-garden permaculture (1,800)

Communities in areas with reduced water availability had in an reduced knowledge of borehole-garden permaculture as did those in areas with increased malaria susceptibility. These are some of the communities that could most benefit from borehole-garden permaculture.

The proximity of a community to a borehole-garden permaculture practising waterpoint was a significant variable in where borehole-garden permaculture had been heard of.

Waterpoints in areas with reliable rainfall were more likely to adopt borehole-garden permaculture, highlighting the issue of competing water priorities

Waterpoints with more women on the water-point committee were morelikely to adopt borehole-garden permaculture, perhaps reflecting that these committees were more likely to be following best practise guidelines in borehole-management.

Variable	BGP Awareness	BGP Adoption
Socioeconomic Variables		
Female-headed household	+	—
Healthcare infrastructure		+
Mother education level	+	+
Population density	—	
Poverty	+	+
Biophysical Variables		
Irrigation	+	+
Malaria susceptibility	—	
Precipitation trend	+	+
Riverine flooding	—	—
Soil organic carbon	—	+
Market accessibility time	+	+
Distance to BGP practising waterpoint	—	
Temperature trend		+
Waterpoint (WP) specific variables		
Maximum distance a user walks to the WP	+	+
Number of months water is unavailable		—
Number of users of the WP	+	
Number of women on the WPC	NS	+
Preventative maintenance performed	—	
Tariff or user fee for the WP	+	

Table 1: Summary of the results of analysed variables on borehole-garden permaculture knowledge and adoption in a the minimal-variable GLMs in which variables were selected by positive variable selection. (+) denotes a significant positive variable estimate, (-) denotes a significant negative variable estimate and 'NS' (not significant) is written for any variable estimate with a p-value of >0.05

Key policy recommendations

A new focal area for borehole-garden promotion

Areas where communities could benefit most from borehole-garden permaculture due to unreliable rainfall and high malaria susceptibility, were less likely to be aware of borehole-garden permaculture. This research proposes that stakeholders, including the Government of Malawi and NGOs should focus on expanding the awareness of borehole-garden permaculture to communities in areas that could benefit most from the technique.

Increase collaboration

Capitalising upon social contacts both between neighbouring communities and external service providers could provide an efficient mechanism of expandingthe awareness of borehole -garden permaculture inMalawi. Furthermore, t he encouragement of borehole-garden permaculture provides a mechanism to promote other good practices in waterpoint management such as the development of a waterpoint committee and ensuring maintenance of water-points.

Context is key

Borehole-garden permaculture adoption must also be considered in the context of the specific community and waterpoint, accounting for limitations in the context such as land ownership challenges or conflicting priorities for land and water usage such as livestock..However, the context of communities may also present an invaluable asset through pre-established social capital.