coffee & climate
enabling effective response

Case study - Rainwater harvesting basins

Case Study Background Data		
Tool category: Adaptation on the farm		**Detail:** Planting Density: 0 – 1000 Soil Type: Loamy soil Shade Regime: 0-10% Farming System: Traditional agro-forestry system Yield Range (kg cherry /ha): 2001-4000 ⦸ rain : 900-1800 mm/y
Variety: Arabica		
Climatic Hazard: • intermitted rains • unpredictable rain • drought during flowering		
Expected Outcome: • reduced water runoff • reduced soil erosion • increase water holding • increase soil moisture		
Implementation date: 22.10.2013 – to date (Sep 2015)	**Altitude**: 1647.4m **GPS:** 8°35'24.0"S 33°13'48.0"E	**Slope of plots:** <10% ⦸ **Age of trees:** 5 - 10 years
No. farmers: 260	⦸ **Area under coffee**: 1.5 ha/farmer	Tested with smallholders

Results

Rainwater basins have proven to be a suitable technique for capturing and holding rainwater in the field for a longer time so that more of the water can infiltrate into soil hence it protects against runoff and soil erosion. The basins referred to here are a type of micro-catchment rainwater harvesting structure with typical dimensions of 0.6m x 0.6m and 0.3m deep.
If rainfall is less intense, the soil in and around the water basins stays wet for 1-3 days and if rainfall is heavy the basins will hold water, which would otherwise severely cause soil erosion. Through the basins the water is conserved through infiltration in the ground, thus soil can retain moisture for a longer dry period.

Pros & Advantages + Learnings	**Cons & Disadvantages + Things to take into account**
• Basins are simple to construct, using hand hoes and can be introduced with minimal disruption to production. • The method is preferable to current practice of digging basins around coffee tree trunks, since that practice can significantly damage feeder roots. • Rainwater harvesting improves soil moisture and maximizes water availability for coffee trees. • Little rainwater is lost through run off and risk of soil erosion is minimized.	• If there is an intense rainfall, the basins can overflow. • If plots are devoid of plant cover or mulch, rain-induced soil movement with the field can quickly fill the basins • Labor is needed for digging the basins. • Surface becomes more uneven, hence routine agronomic activities can become more time-consuming.

Acceptability	High	**Effectiveness**	High
Affordability	High	**Timing / Urgency**	High

What is the objective of applying the adaptation option and how do we expect the objective to be met?

Description of climatic hazard and associated problem: Through the triangulation process, unpredictable rains, intermitted rains, and drought during flowering have been identified as a major climatic risk for smallholder coffee farmers in Mbeya rural, Tanzania. This leads to a high rate of flower abortion and decreases production.

Description of expected outcome: Digging basins in between the coffee trees is expected to hold rain water in the basins and increase the soil moisture content in the respective areas on the field. The improved water availability will decrease the risk of flower abortion and lead to higher yields.

How is the adaptation option applied?

Nr.	Step	Picture
1	Training on rainwater harvesting basins covering the aspects: • Sensitization on the change of rainfall patterns and their effects on coffee production • Importance of the rainwater harvesting technique • How to dig basins in order to capture water	
2	Demonstration on the demo plot how to dig the basins and how they will hold rainwater: • Choosing locations for the basins between the coffee trees (not around the trunks) • Preparing basins with the hand hoe and simple measurements	

3	Digging the rainwater basins between the coffee trees	
4	Compare soil moisture in and around the water basins after rainfall in plots with basins and plots without	

Implementation framework

The case study is implemented within the pilot project of the initiative for coffee & climate in Mbeya rural, Tanzania since end of 2012. As part of the national program implemented by the Hanns R. Neumann Stiftung (HRNS) in Tanzania, the c&c pilot project is targeting 1,300 coffee farming households. Besides facilitating discussions on the impact of climatic changes on coffee production, HRNS is supporting testing of different adaptation options on demo plot level. Demo plots are parts of farmers' fields who are members of farmer groups, which use the demo plot as training grounds as well as show grounds for best agricultural practices.

This practice was applied on 6 demo plots in the Mbeya rural district before the rainy season in 2013/14. 260 farmers participated during discussions on the impact of climatic changes on coffee production and rainwater harvesting as potential adaptation option. Positive results could be observed during the first rainy season and further promotion of this adaptation practice in ongoing.

Measurement strategy for effectiveness

Indicator	Soil moisture content
Definition	Soil moisture in and around the water basins 2 days after rain
Purpose	Soil moisture content is an effective on-farm indicator since it can easily be observed by the farmers themselves if they use the hand feel method (see below).
Baseline	No baseline data is available since the comparison is done between fields with water basins and fields without.
Target	The target is that the soil moisture content in fields with water basins is higher than in fields without, 2 days after a significant rainfall event.
Data Collection	The demo holders and their farmer group members compare the soil in and around the basins 2 days after rain. The project staff supports with the hand feel method and facilitates the observation as well as the discussion about the results.
Tool	Hand Feel Method The hand feel method is a fast and simple method where comparisons can be done frequently without further equipment. The soil moisture content is compared directly between fields with basins and fields without basins. Since no exact soil moisture needs to be determined, this method is sufficient and can be applied directly by the farmers in the field. The hand feel methods was applied based on the guidelines provided in http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs144p2_051845.pdf
Frequency	After each rain
Responsible	The 6 demo plot holders
Reporting	The results of the comparison are discussed during Farmer Field School meetings and c&c trainings within the farmer groups on the demo plots.
Quality Control	Although the hand feel method is subjective, farmers are responsible by themselves to collect that information and do the direct comparison. Therefore they become aware of the difference, if applying water basins in their fields.

Measurement strategy for acceptability, affordability, timing & urgency

The comparisons of soil moisture with the hand feel method was facilitated on each of the six demo plots by the demo holders for their group members with support of HRNS staff. In addition, the comparison was taken up during FFS sessions conducted on the demo plot by the demo holder and during informal meetings with neighboring farmers. In total about 260 farmers experienced the different structure of the soil on field with and without.

The findings regarding the criteria acceptability, affordability and timing & urgency of the adaptation option water basins have been collected during group discussion with farmers of the respective groups with the 6 demonstration plots.

Main findings of case study

During the discussions on the demo plots all of the farmers realized that the soil is more humid compared to a field without basins. They also mentioned that, if you apply basins in the field, nutrients are stored and crop healthy is enriched with soil fertility while the plot without rainwater basins, nutrients are washed down by run offs and soil erosion become prominent in such field.

Since farmers have dug basins around trees for input applications, the digging of basins between the coffee trees is a new approach. Most farmers were hesitant to trying it before seeing the expected effect. Therefore the adaptation option was first introduced on demo plots to showcase the positive effects on the soil moisture content and how it supports the resilience against intermittent rains and even drought of the field.

Acceptability					
Leading Question: To what extent did farmers readily accept this tool as useful for implementation and implement it as planned?					
High	X	**Low**		**Don't Know**	
High: Farmers readily accepted this tool for implementation and continue to implement it as planned.					
Please Comment:					
If there was resistance to adopting this tool, why?	No resistance.				
If farmers discontinued tool implementation later on in the process, even though they initially accepted it, Why?	After seeing the benefits on the demo plots, farmers have started to implement this adaptation option in their fields.				
Did this tool have any external issues or impacts (positive or negative) which influenced its acceptability? (community, value chain?)	Some farmers also use the basins for adding compost manure.				
Any other comments:	Farmers have been sensitized on the problems of digging basins around coffee trees compared to digging them in between.				

Affordability					
Leading Question: Are the costs of the tool affordable to farmers taking into account the initial investment, maintenance costs and the availability of inputs?					
High	X	**Low**		**Don't Know**	
High: The initial investment and the maintenance costs of this tool are affordable to farmers from their regular operations and the time it takes to recover the investment is reasonable to farmers.					
Please Comment:					
Are there any external costs? (to society or environment?)			Labor and equipment (hand hoe). However, most farmers own a hand hoe and use family labor for digging the basins, thus no costs occur for them.		
If costs are high because inputs are not available, what inputs? And why?			n.a.		
Any other comments:			-		

Effectiveness					
Leading Question: Does the tool provide the expected benefits to farmers?					
High	X	**Low**		**Don't Know**	
High: The objective of the tool has been met for the farmers.					
Please Comment:					
What benefits did farmers expect from this tool?			Improving soil moisture and reducing soil erosion decrease the vulnerability of coffee trees to drought and unpredictable rains.		
If the objective has not been met, why?			n.a.		
Have there been any significant external issues which influenced the effectiveness (positive or negative) of this tool? Please explain.			Basins also hold water in case of heavy rains and reduce the risk of soil erosion and runoff.		
Any other comments about effectiveness:			Wherever possible, this tool should be used together with ground cover to limit infilling from soil erosion during heavy rainfall. The basins can trap wind eroded materials, which acts as compost.		

Timing / Urgency					
Leading Question: Is the amount of time that this tool takes to implement (from starting implementation until benefits accrue) reasonable to farmers?					
High	X	**Low**		**Don't Know**	
High: The tool takes a reasonable amount of time to implement (taking into account the coffee growing season, inputs necessary, preparation time and implementation time); *And* this tool accrues the effects expected within a reasonable amount of time.					
Please Comment:					
If implementation takes too long why?			n.a.		
Any other comments about timing:			Basins can be dug any time before the rainy season and require minimal, but regular maintenance.		