

# Modelling and impact assessment of water harvesting



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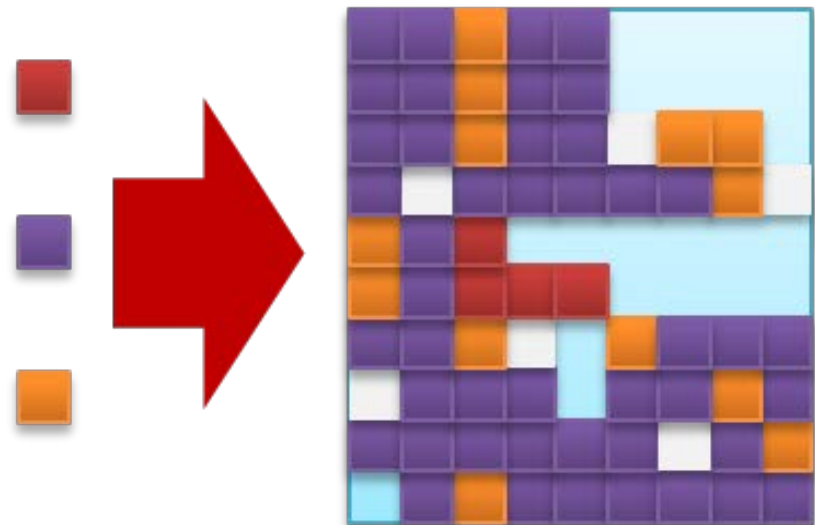
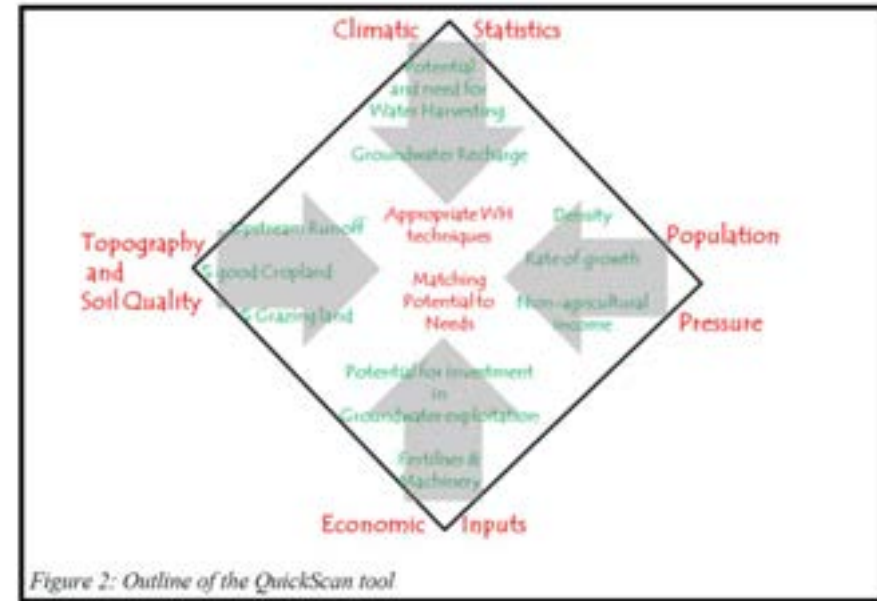
**Brian Irvine, Mike Kirkby**

Presentation for Final WAHARA meeting  
Livingstone, Zambia  
10 February 2016



# Two modelling approaches

- Rapid evaluation of water harvesting potential (Quick Scan Tool)
- Upscaling the assessment of water harvesting (PESERA-DESMICE Model)



# Quick Scan Tool

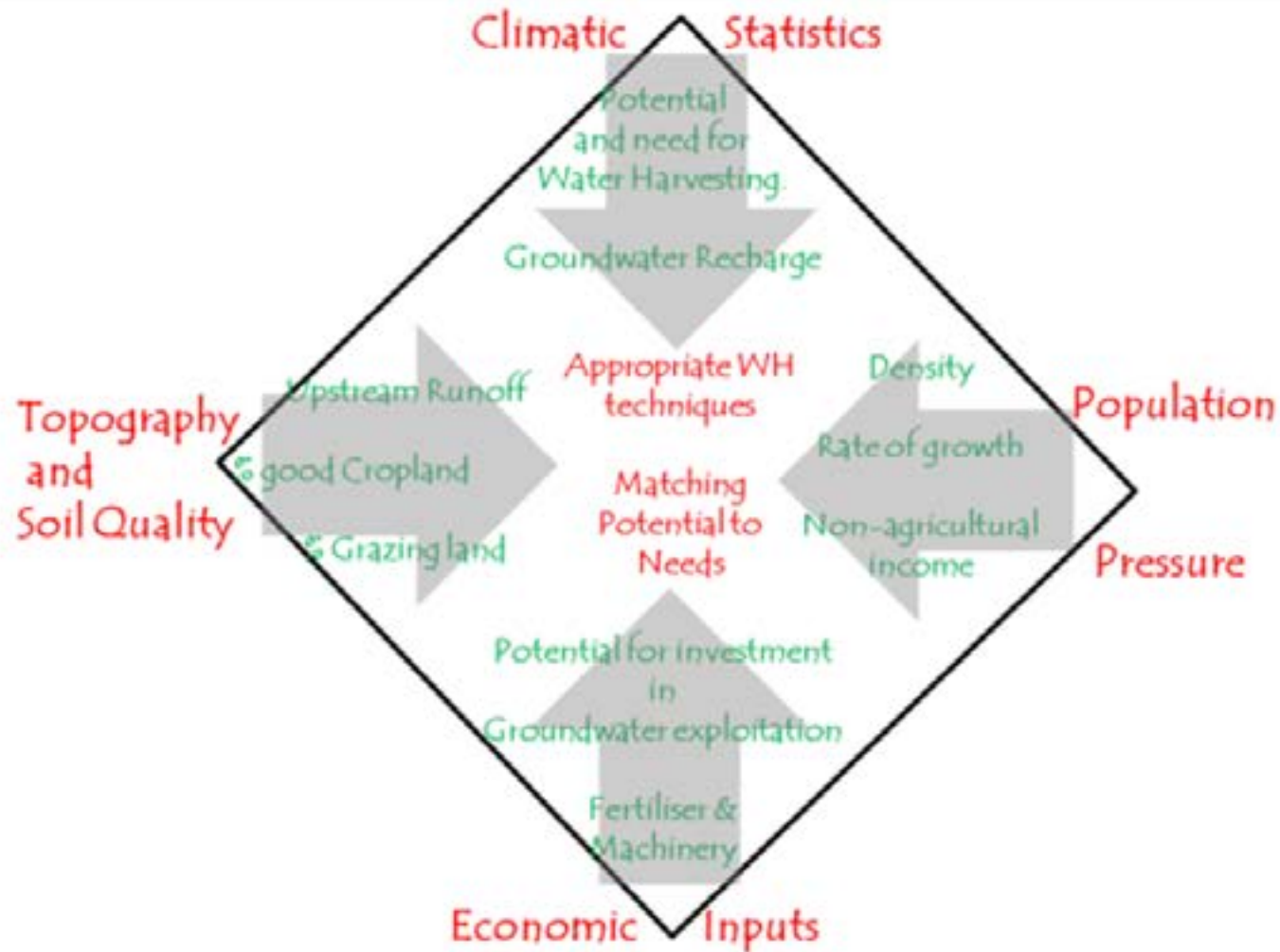
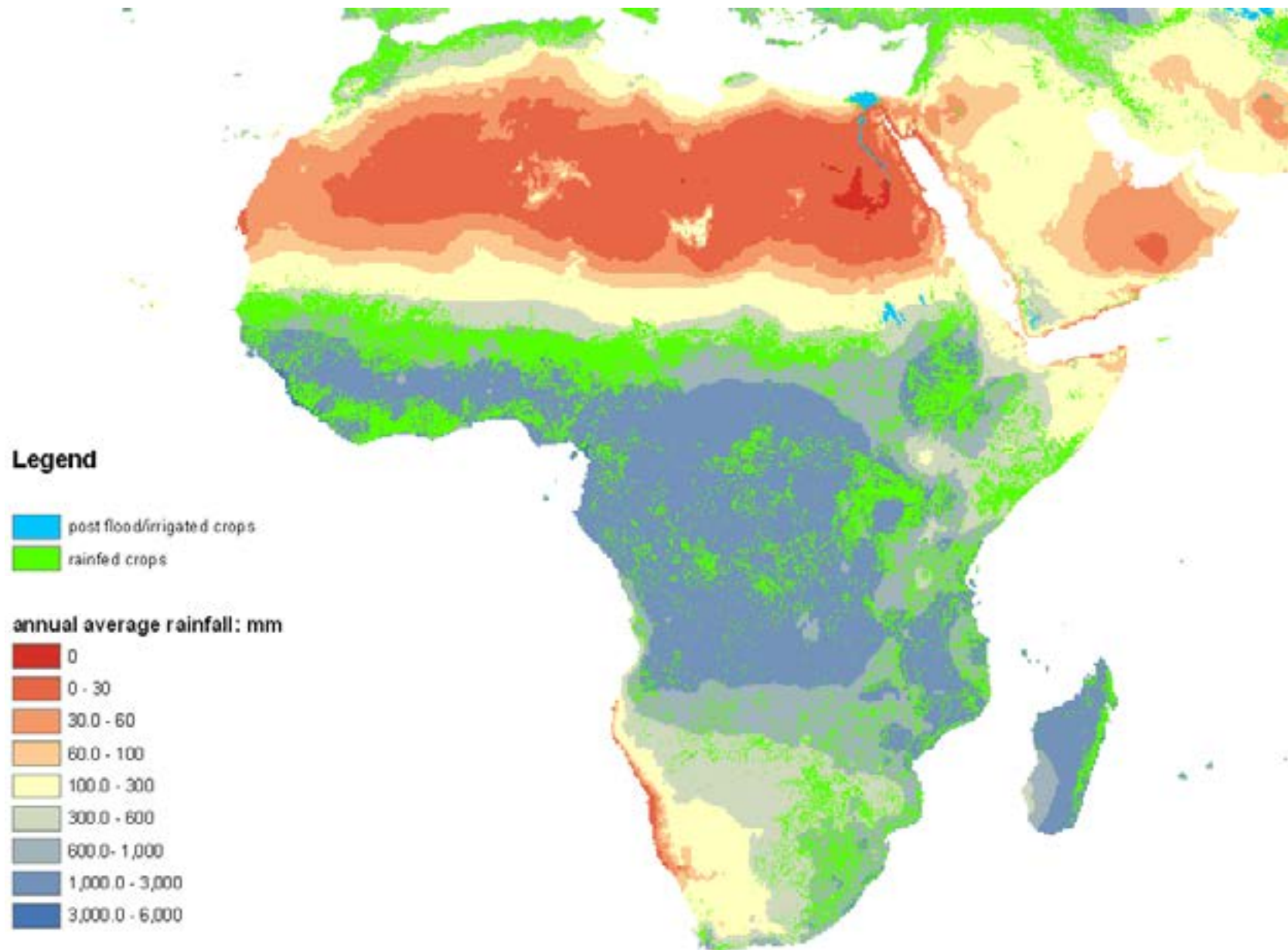


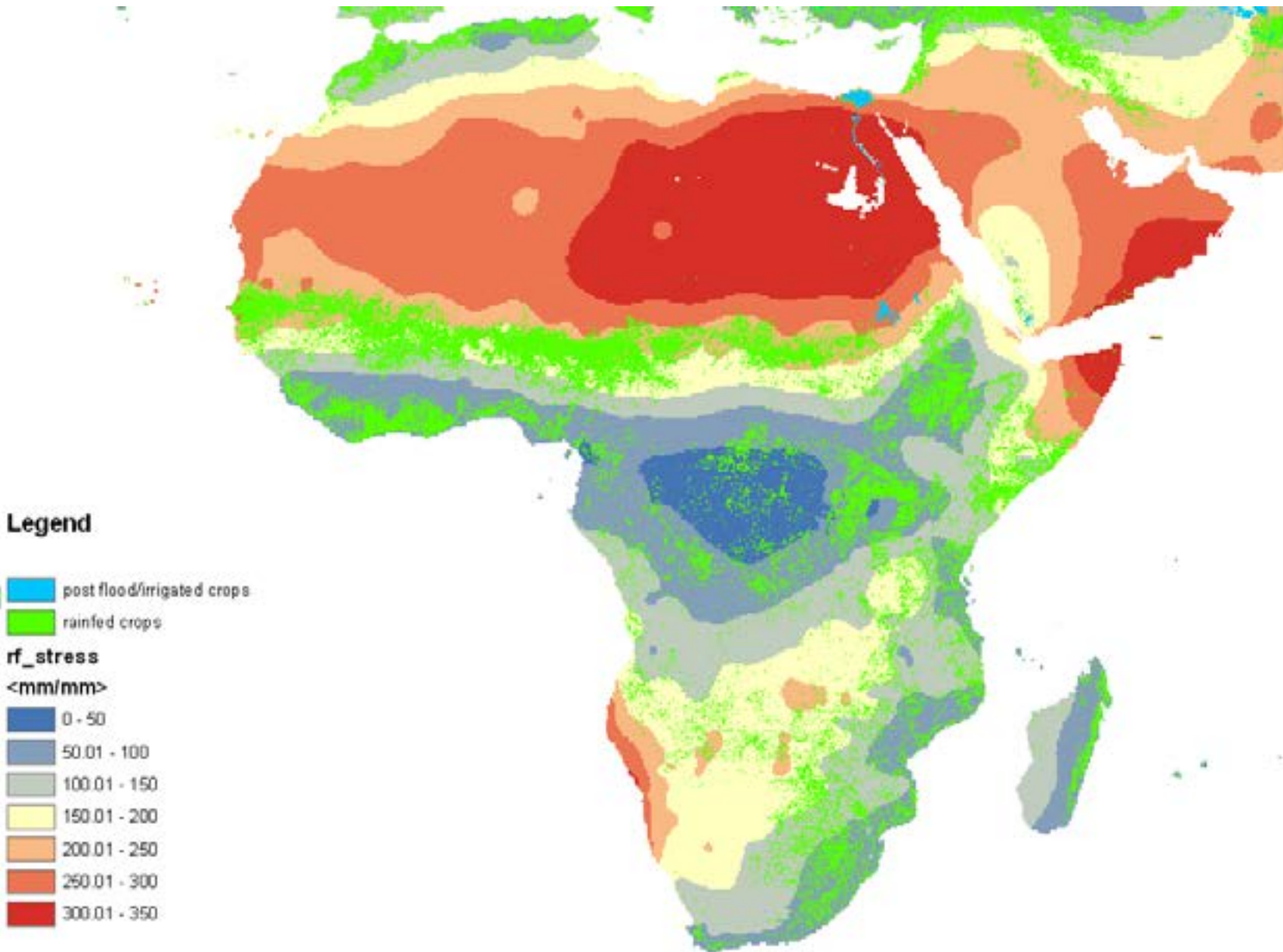
Figure 2: Outline of the QuickScan tool

# Where is the rainfed cropland?

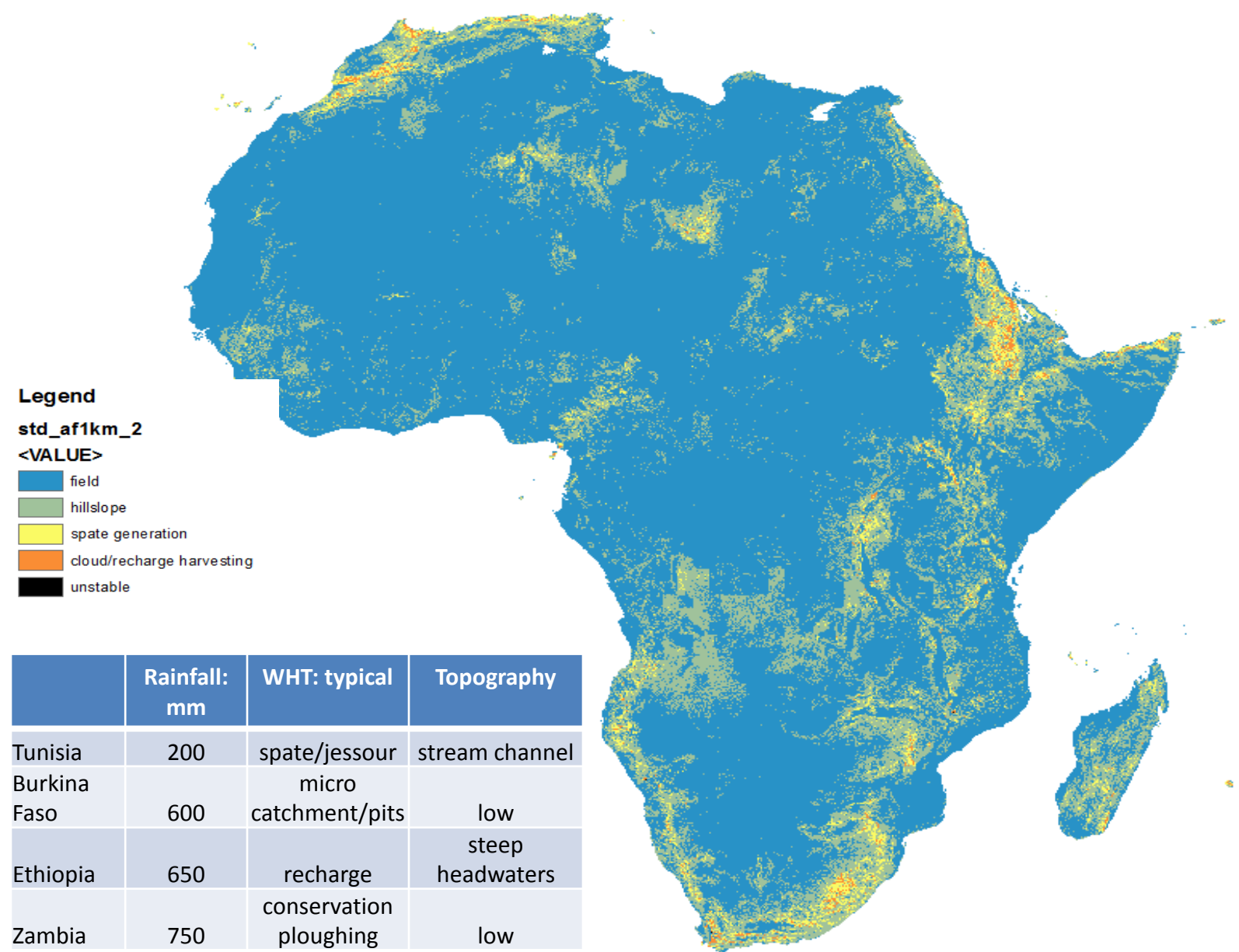




# Water stress for crops



# Potential for different types of water harvesting



# Reducing risk of crop failure through water harvesting

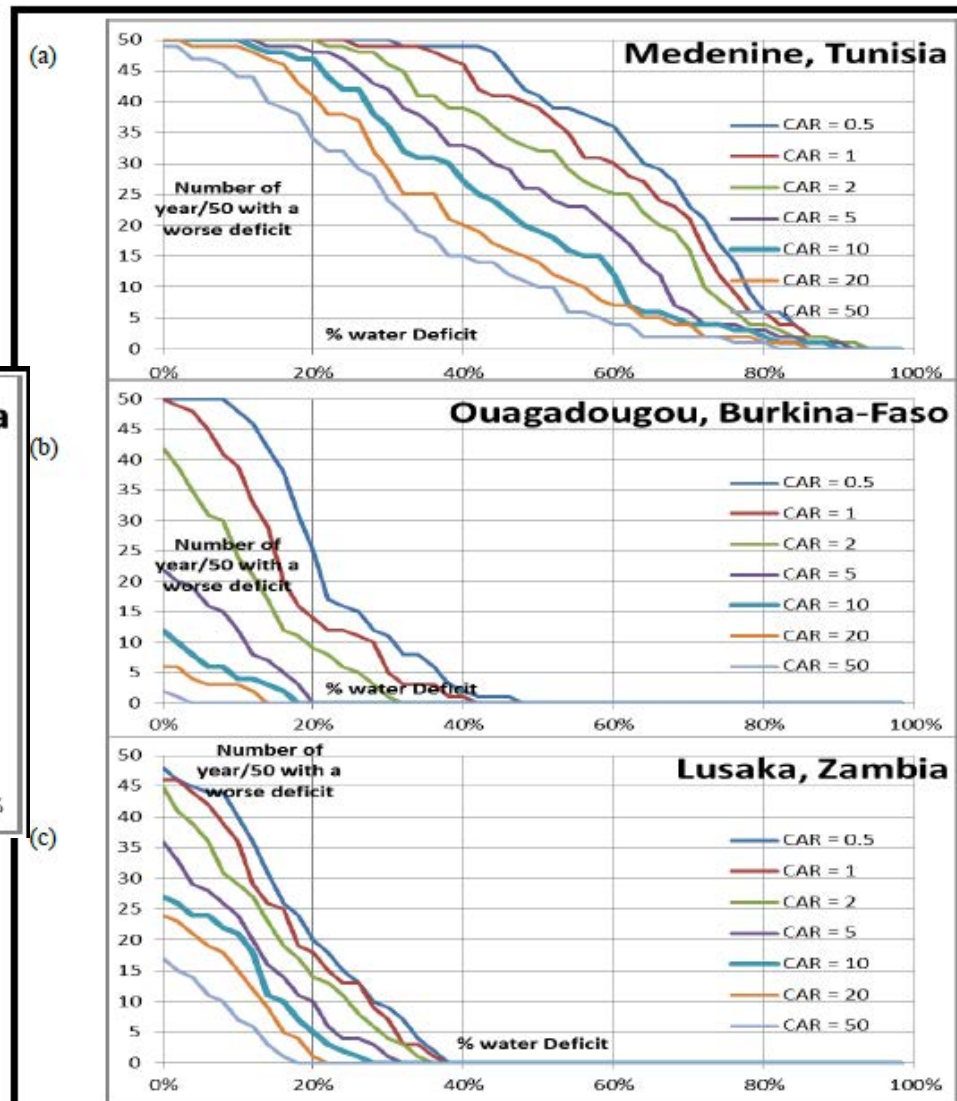
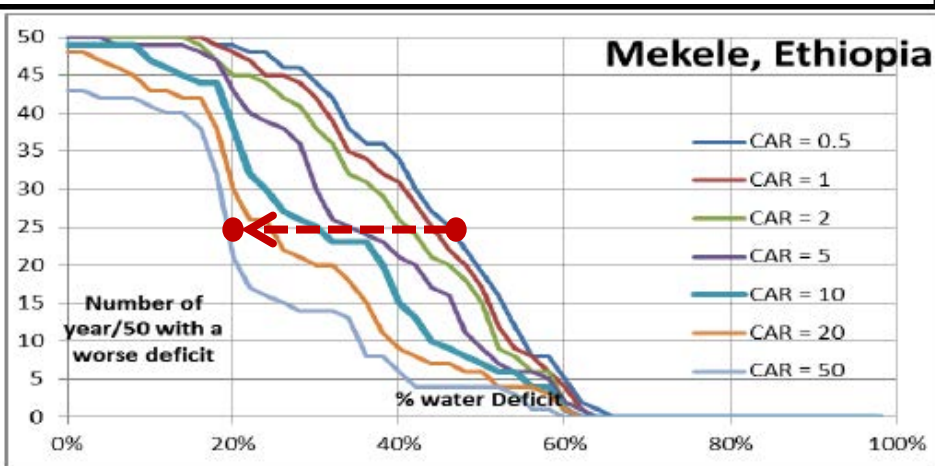
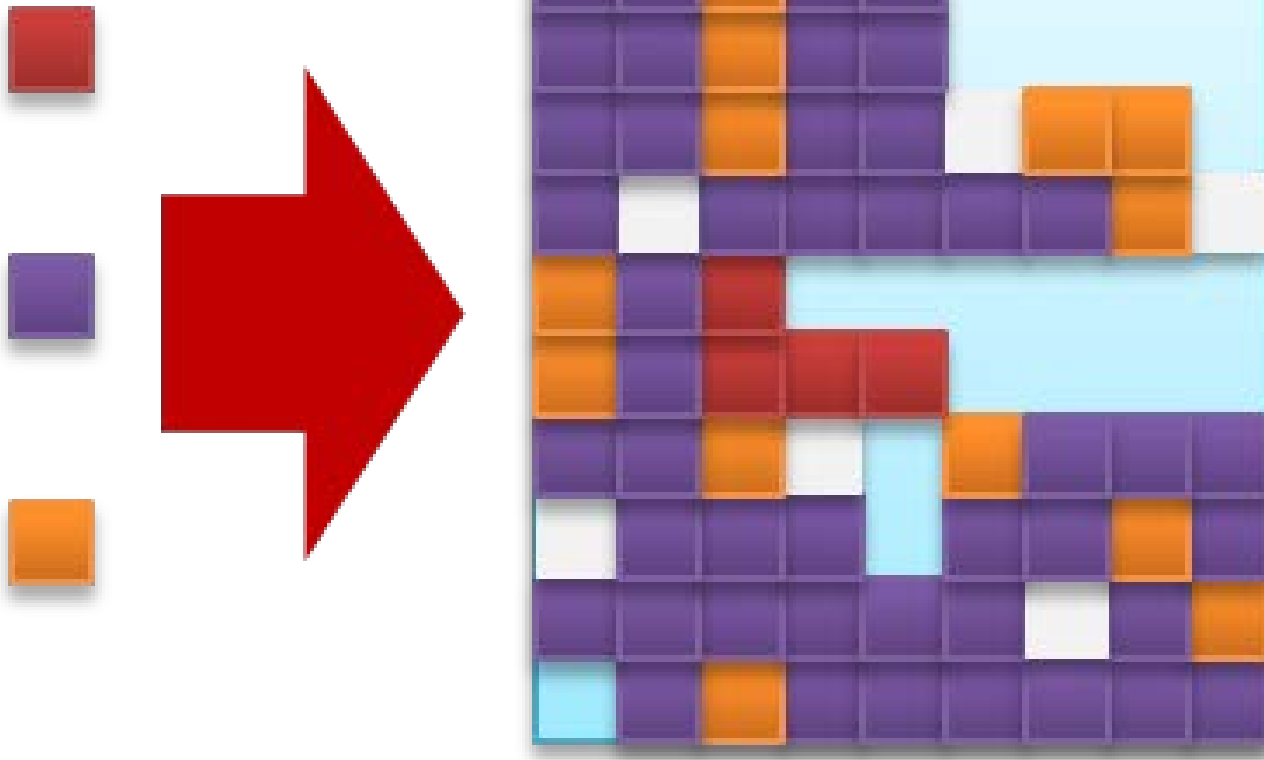


Figure 7. Distribution of water deficit for a range of water harvesting strategies, indicated by choice of Cropping Area Ratio (CAR).  $CAR < 1$  represent conservation measures and  $CAR > 1$  water harvesting measures. (a) Medenine, Tunisia. (b) Ouagadougou, Burkina-Faso. (c) Lusaka, Zambia.

## PESERA-DESMICE modelling

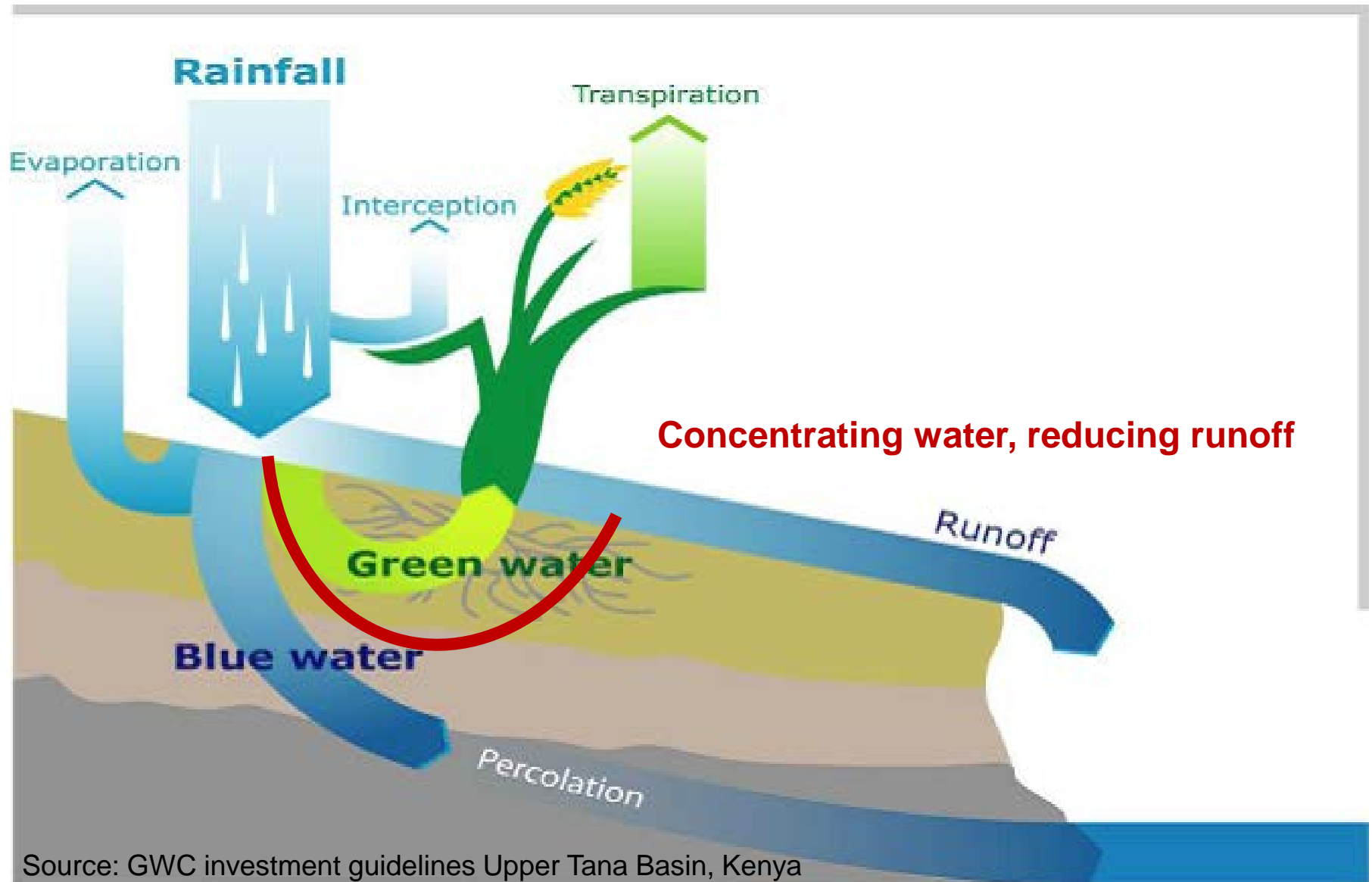




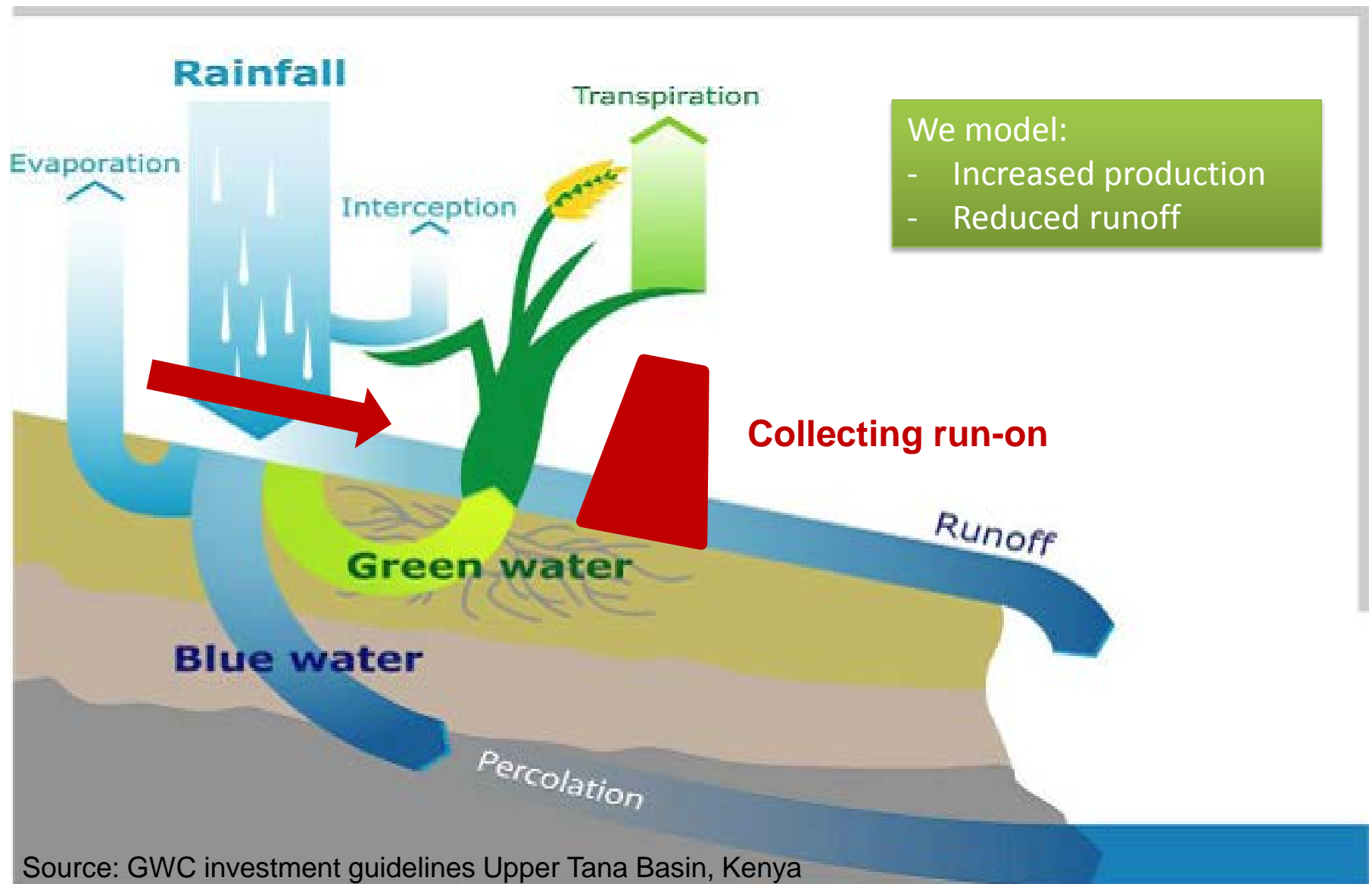
# Why do we model the impact of water harvesting?

- experimental conditions limited  
(weather & environmental conditions)
- trial duration too short  
(long-term impacts not tested)
- opportunity of scenario analysis  
(evaluating performance under extreme circumstances)
- effects across larger scales  
(aggregate effects study site)
- alternative and complimentary approach

# Modelling the water balance



# Modelling the water balance



# Biophysical Modelling approach

In-situ (direct): Zambia and Burkina Faso

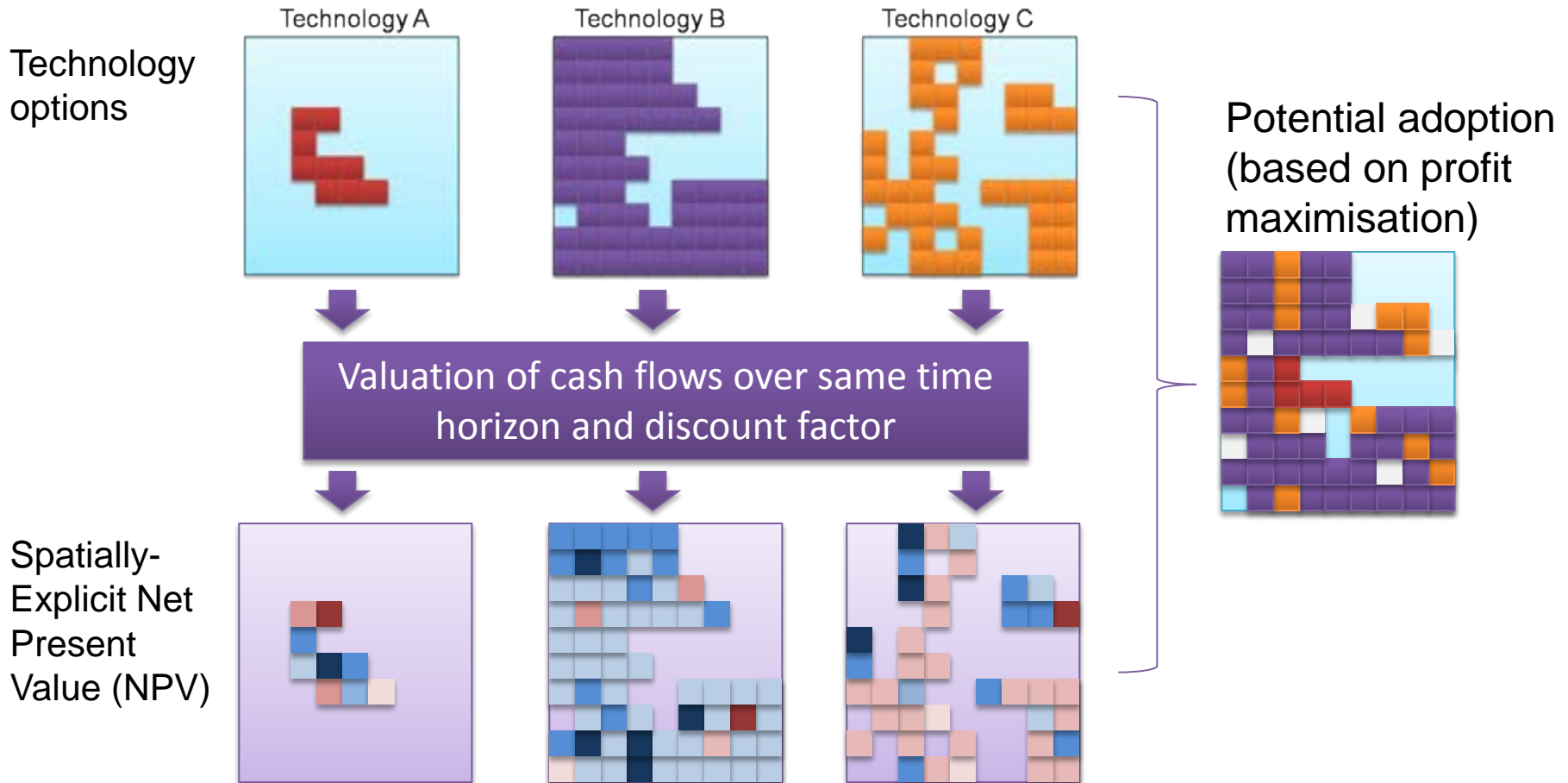
→ Predominantly surface treatments

Landscape: Ethiopia and Tunisia

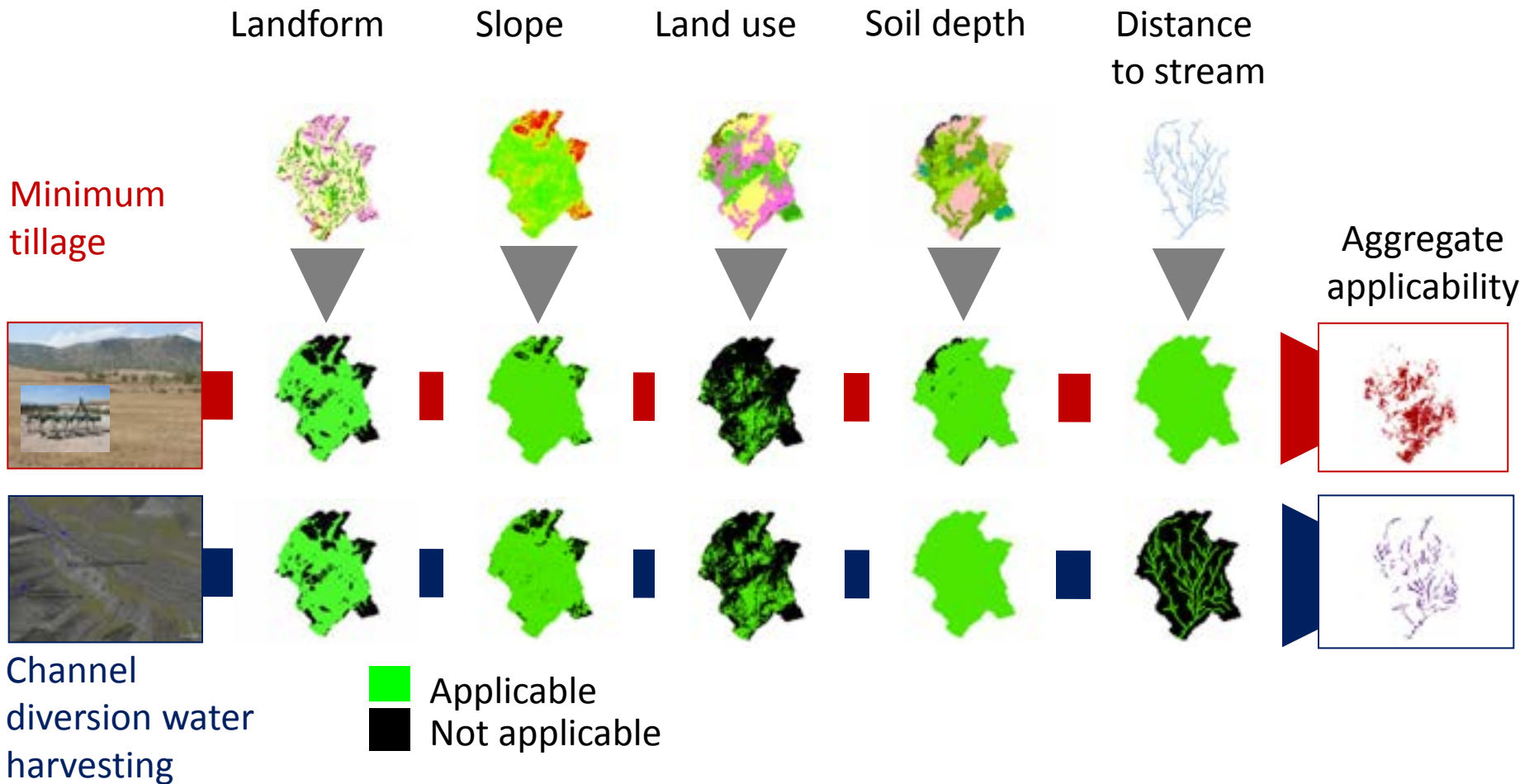
→ Water table management and surface treatments



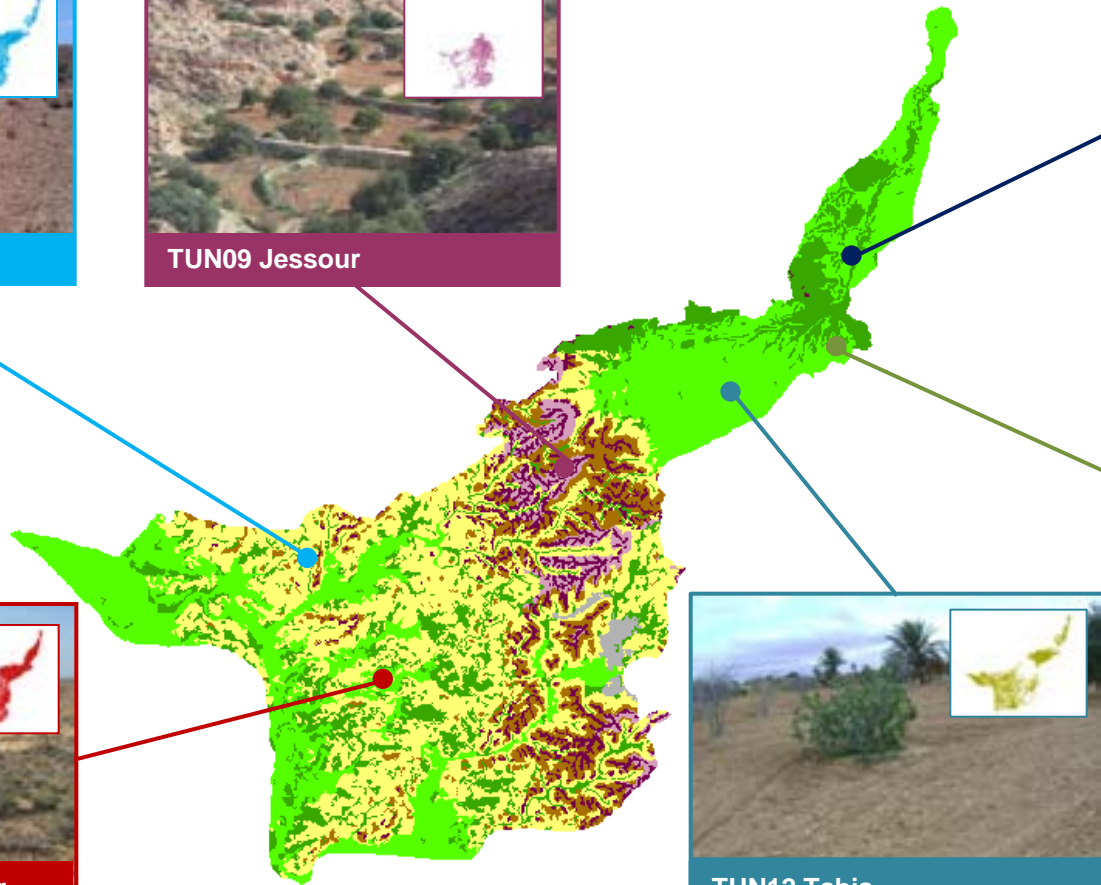
# PESERA-DESMICE as assessment framework



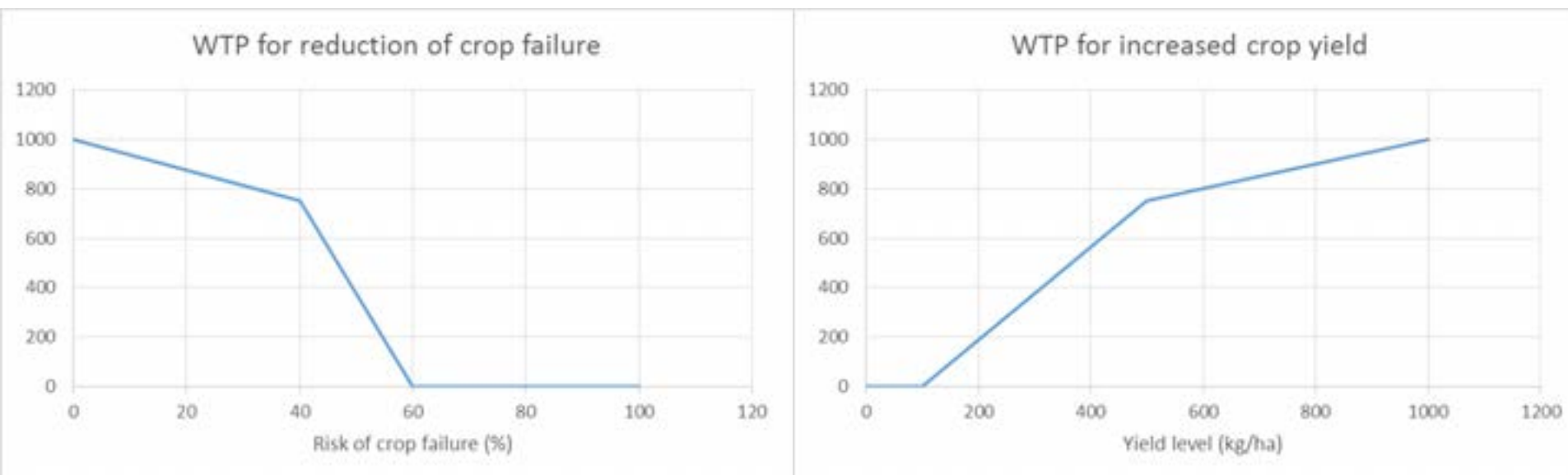
# Applicability limitations



# Applicability limitations of WHT in Oum Zessar, Tunisia



# DESMICE: Integrating risk preference



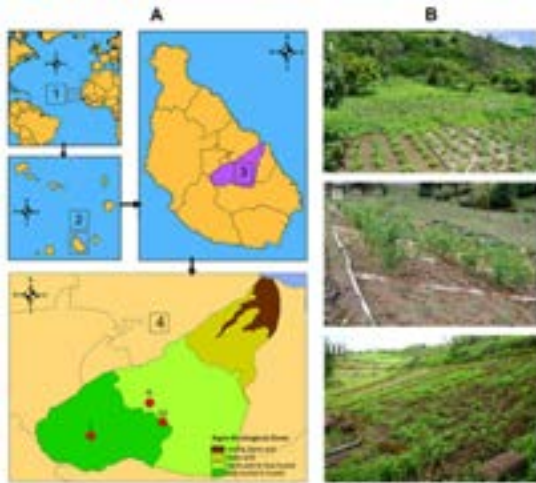
**Table 28 Comparison of aggregated weights attached to productivity and risk reduction impacts of WHT from stakeholder workshops and WTP elicited from CE models without status quo for highest attribute levels**

	Burkina Faso		Ethiopia		Tunisia		Zambia	
	Weight	WTP	Weight	WTP	Weight	WTP	Weight	WTP
Increased yield	56%	1353	35%	8.3	37%	0.1	n.a.	600
Risk reduction	44%	75	65%	6502	63%	287*	n.a.	2.5

\*This WTP is an average of the WTP for low risk for alternative A and WTP for low risk of alternative B



# Risk of crop failure, Santiago (Cape Verde)



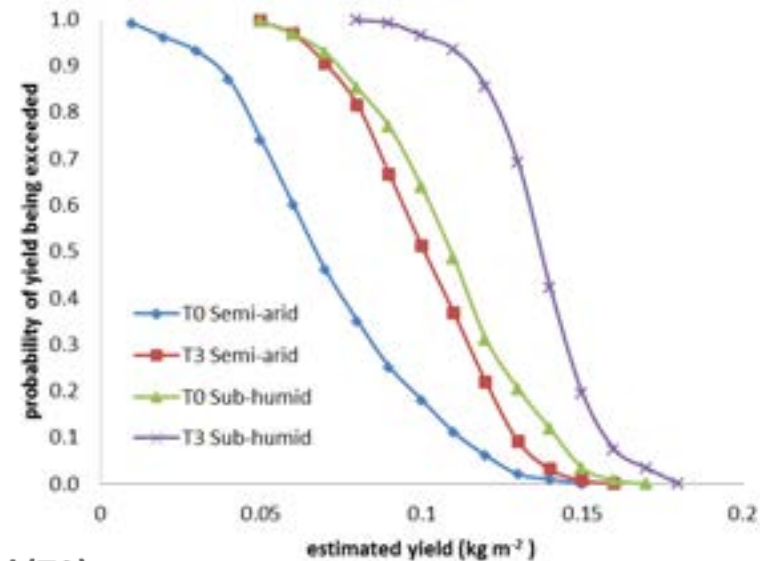
## Comparison

### Baseline scenario (T0)

- Traditional maize/bean intercropping system with no input or conservation measure

### SLM scenario (T3)

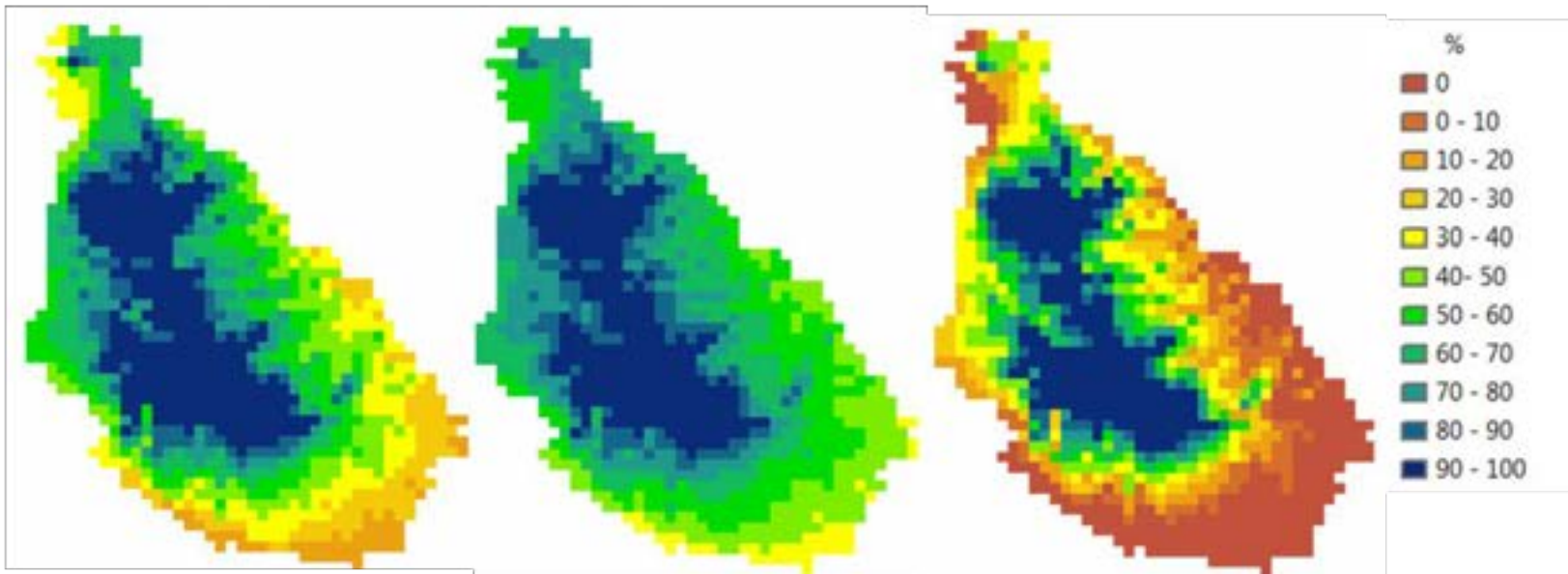
- Combination of mulch ( $4 \text{ t ha}^{-1}$  of crop residue) and organic fertilizers ( $4 \text{ t ha}^{-1}$  of compost/animal manure)
- Pigeon-pea hedges planted cross-slope at 3 m intervals



a. Baseline (T0)  
 $p > 800 \text{ kg.ha}^{-1}$

b. Improved (T3)  
 $p > 800 \text{ kg.ha}^{-1}$

c. Improved (T3)  
 $p > 1200 \text{ kg.ha}^{-1}$



# Zai pits, NW Burkina Faso

## Assumptions:

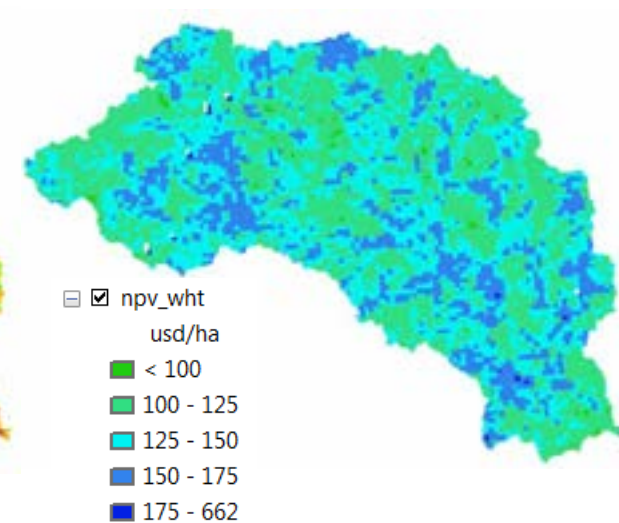
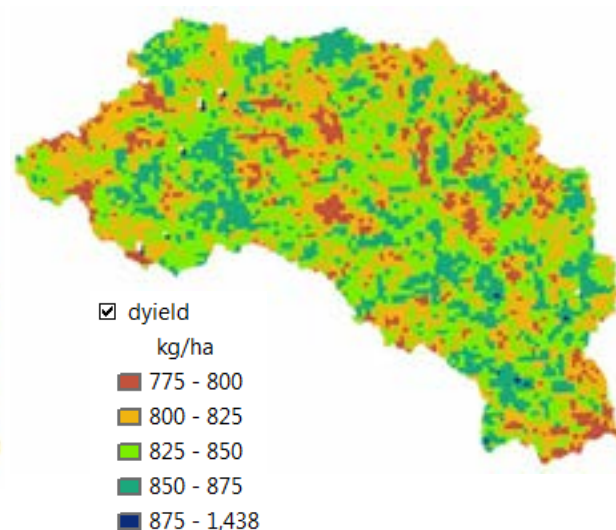
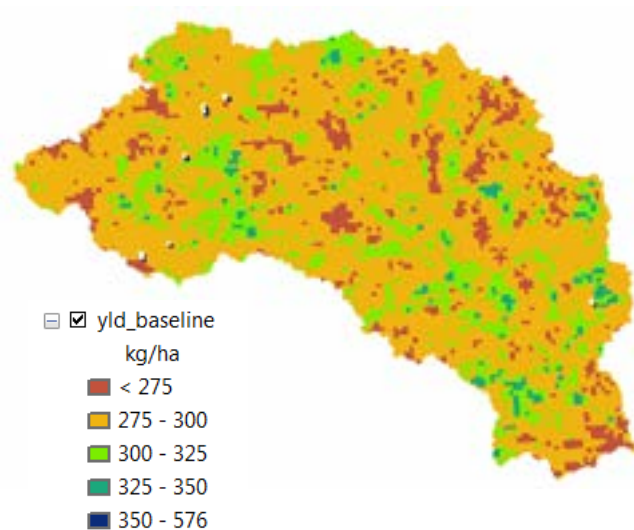
- Investment \$317
- Economic life 3 years
- Harvest index 17-26%
- Sorghum price \$0.25/kg
- Straw price \$0.05/kg
- Maintenance \$115
- Discount rate 10%



a. Conventional yield

b. Yield increase with Zai

c. Net present value



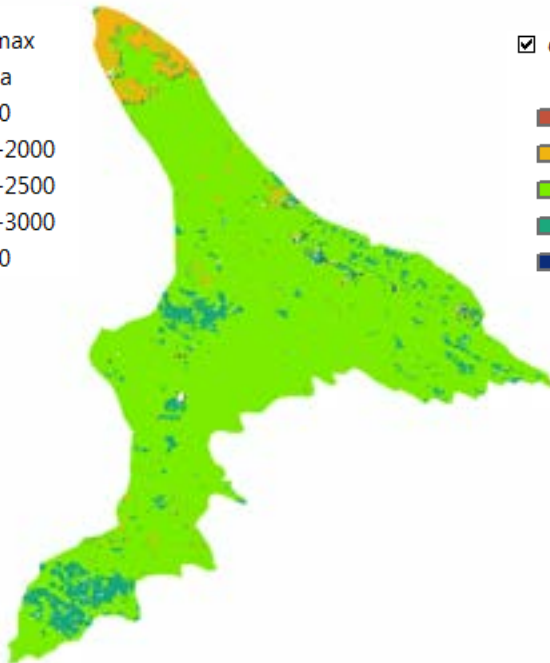
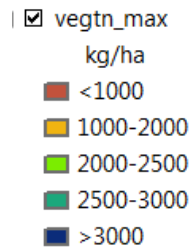
# Magoye ripper, Magoye catchment, Zambia

## Assumptions:

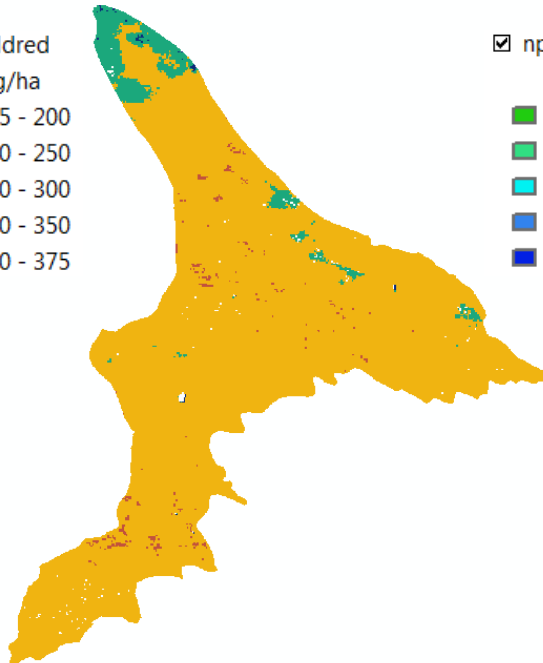
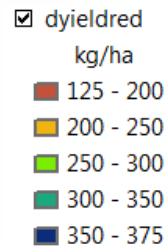
- Price ripper \$130
- Economic life 5 years
- Harvest index 30%
- Maize price \$0.08/kg
- Cost saving labour \$94
- Cost herbicides \$30
- Discount rate 10%



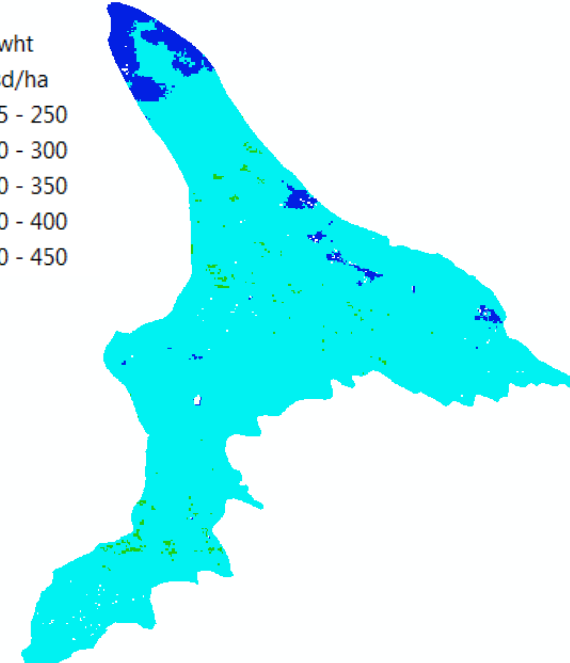
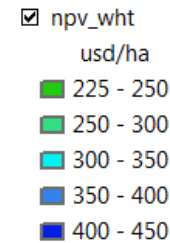
**a. Conventional yield**



**b. Yield increase ripping**



**c. Net present value**









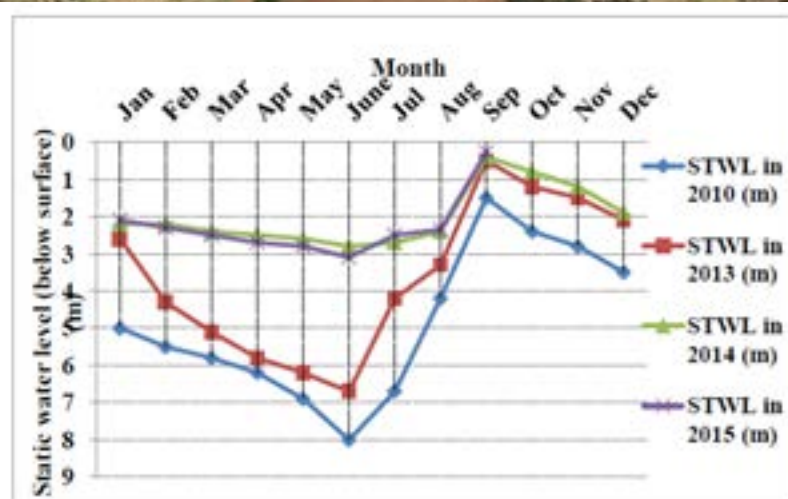
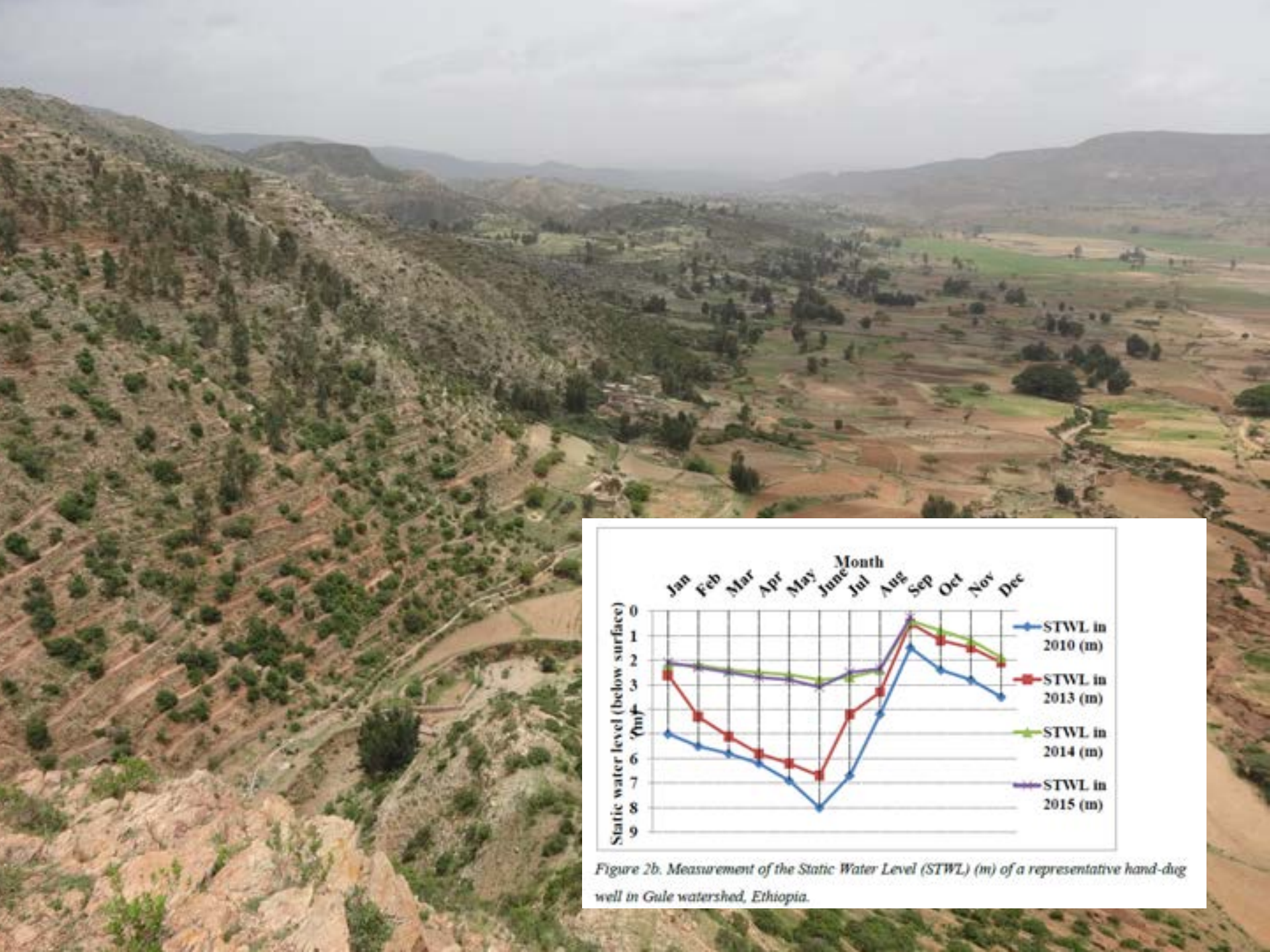
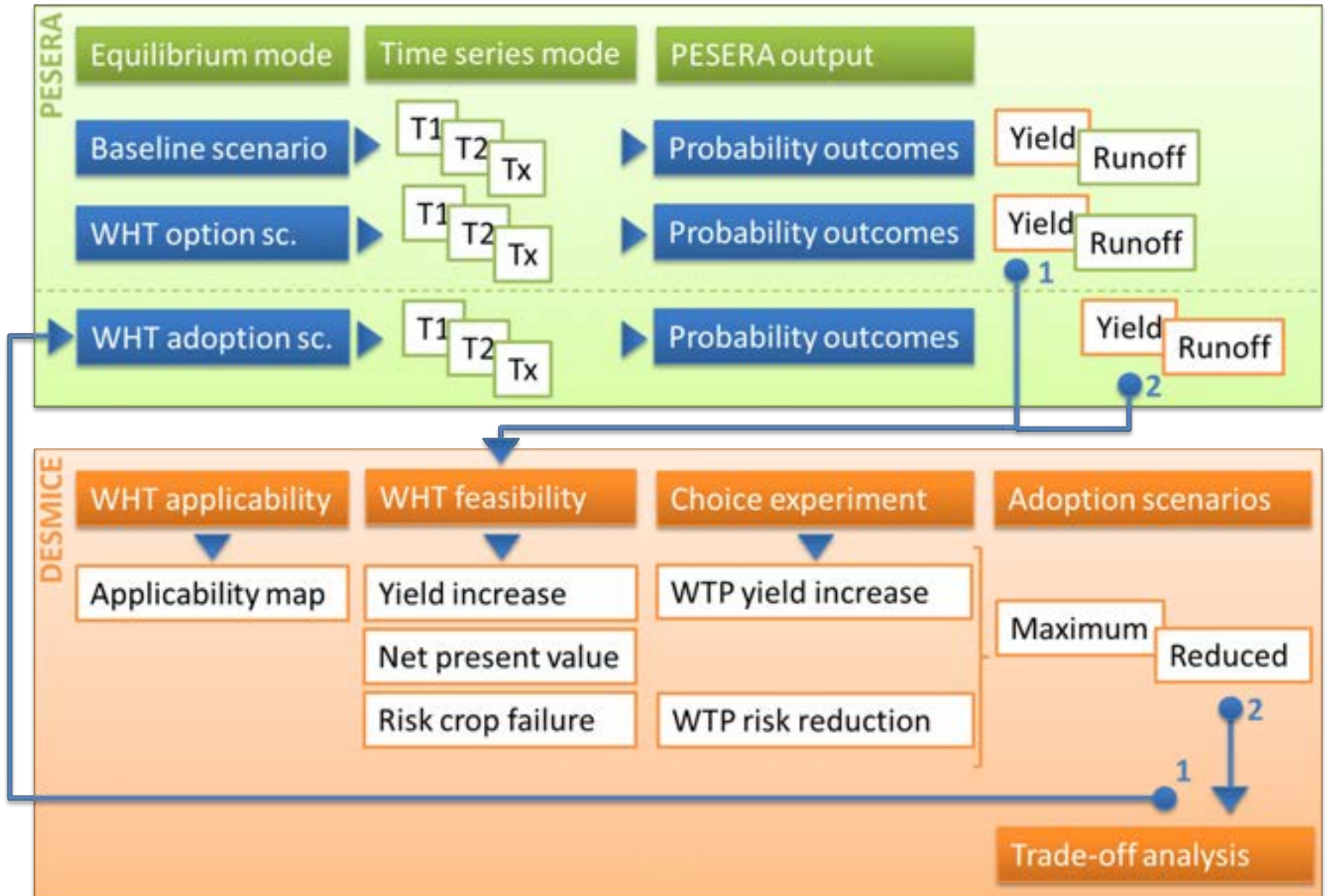


Figure 2b. Measurement of the Static Water Level (STWL) (m) of a representative hand-dug well in Gule watershed, Ethiopia.

# PESERA-DESMICE integration: overview





# Thank you

