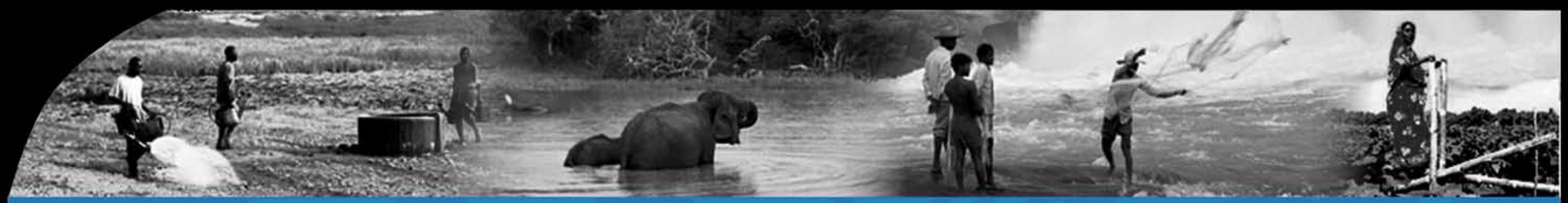


Rethinking water storage for agricultural adaptation to climate change in Sub-Saharan Africa

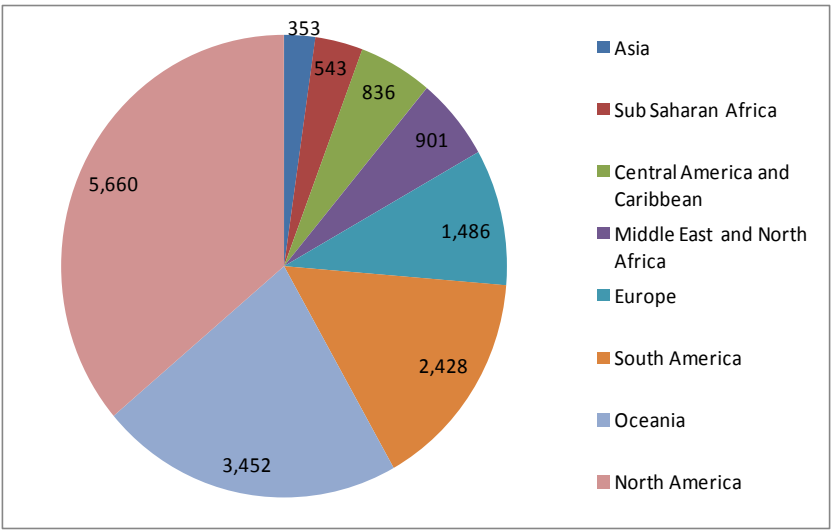
Matthew McCartney

Research funded by:

Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

gtz Partner für Perspektiven. Weltweit.

Background



In sub-Saharan Africa

- Climate variability is high, but water storage is low
- Inability to predict and manage rainfall/runoff is a key contributor to high levels of food insecurity and poverty
- Climate Change will increase variability (even where total rainfall increases)

IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

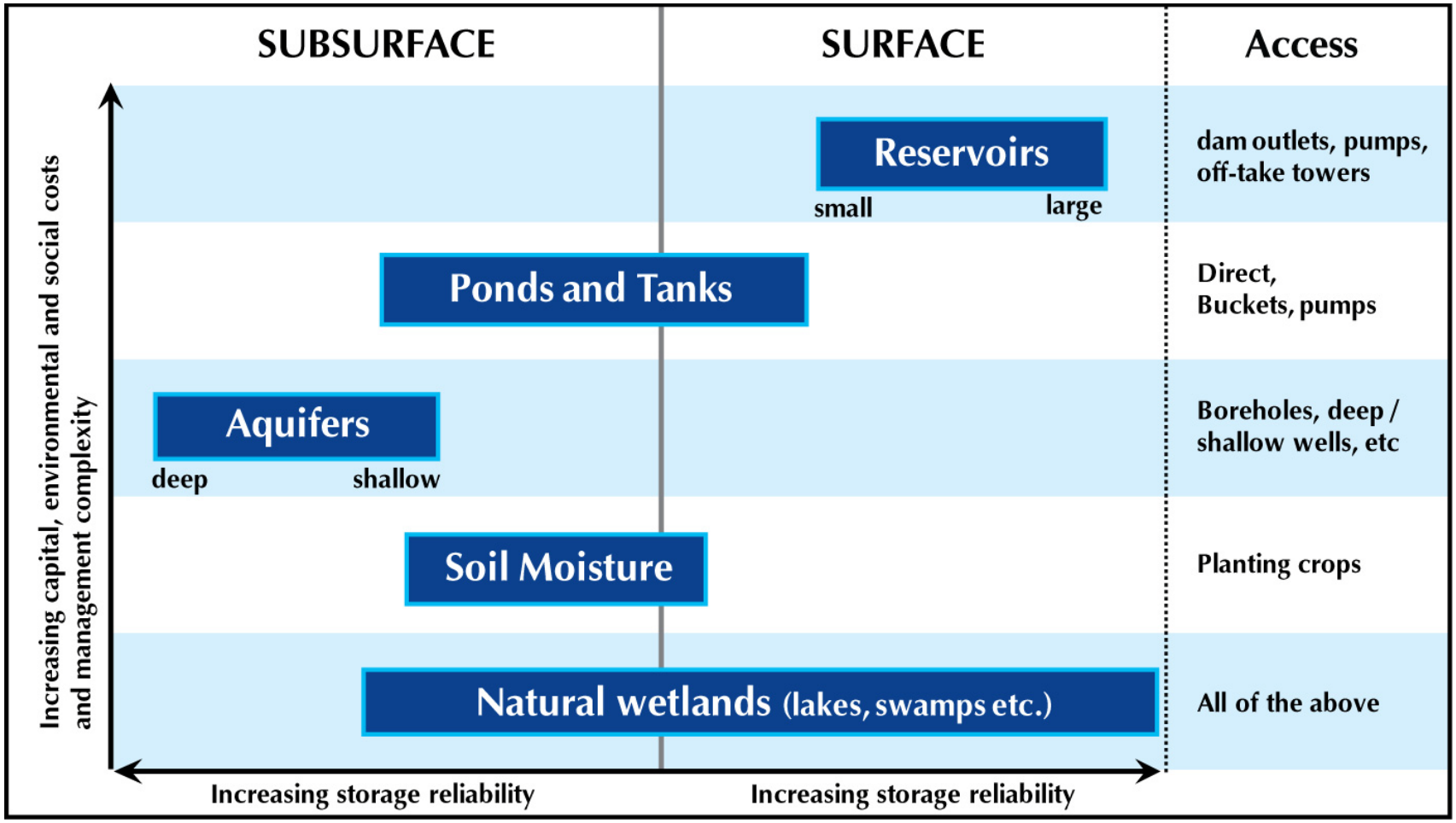
Project Rationale

- Water storage is widely advocated as a key mechanism for CC adaptation
- Little analysis of how CC affects existing water storage or how to account for CC in the planning and management of new water storage

Key Research Question

- How can climate change be built into the planning and management of water storage?

Physical Water Storage Continuum



IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

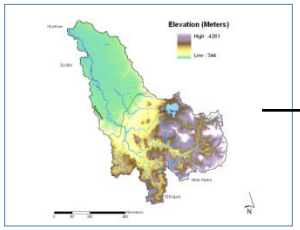
Storage options

- Each type has niche in terms of technical feasibility, socioeconomic suitability, externalities and institutional requirements
- CC will affect the function and operation of different storage types, differently
- Because of uncertainties in CC predictions, storage systems need to be able to function across a range of CC scenarios

IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

Project Approach



Blue Nile basin watersheds
Koga – Gumara – Indris

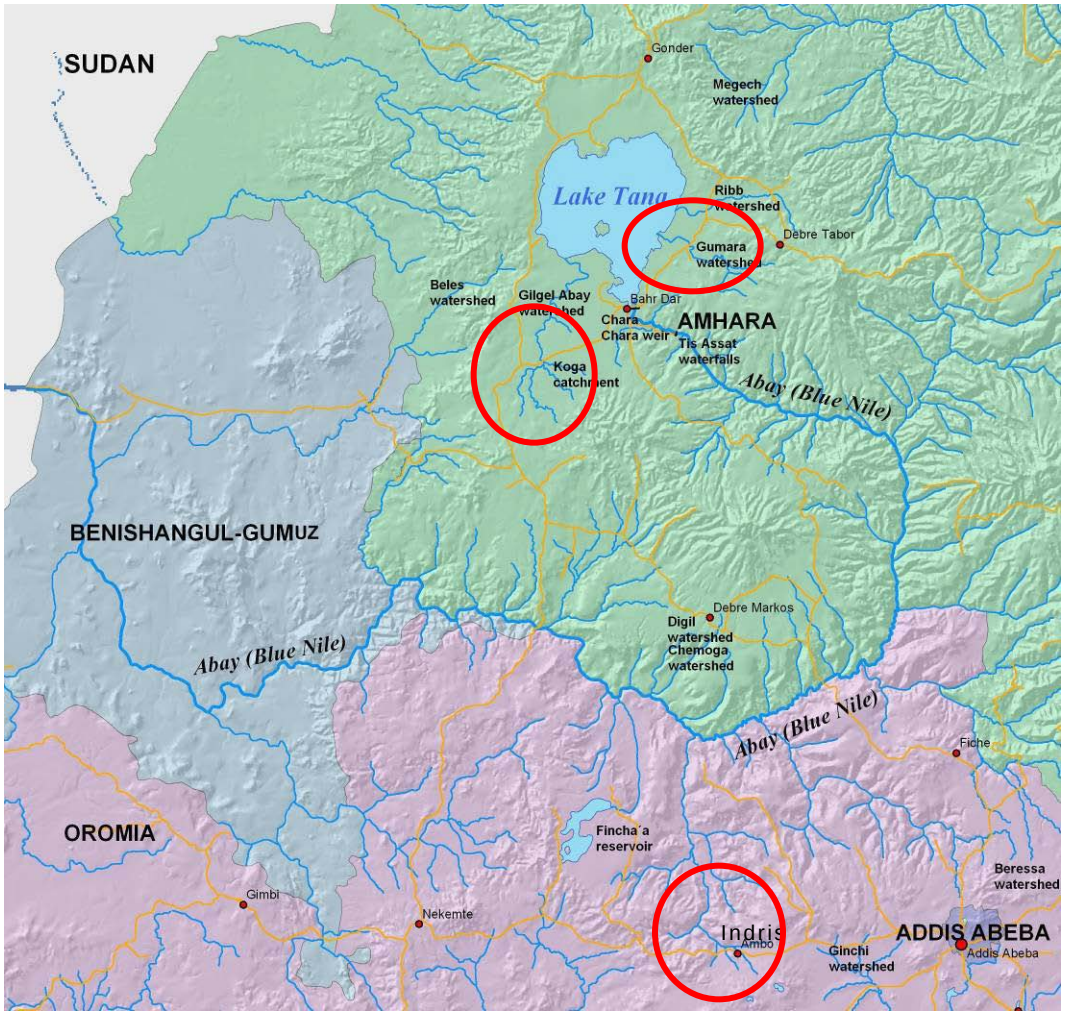
Volta basin watersheds
Vea (Yaragagna) – Saata – Golinga

Basin scale analyses
Evaluation of climate change impacts on storage at basin scale

Site level analyses
Understanding storage at the local (economic, socio-political aspects)

Evaluation metrics
to assist in planning and management of storage

Site Level Analyses



Ethnographic research

- acquisition of storage facilities
- rules & regulations
- land & water rights
- management bodies
- resettlement & compensation
- livelihood change
- gender aspects

Socio-economic surveys

- 200 households per watershed
- identification of water sources
- cost & benefits of water storage
- farmers´ perception of storage and climate change

IWMI International Water Management Institute

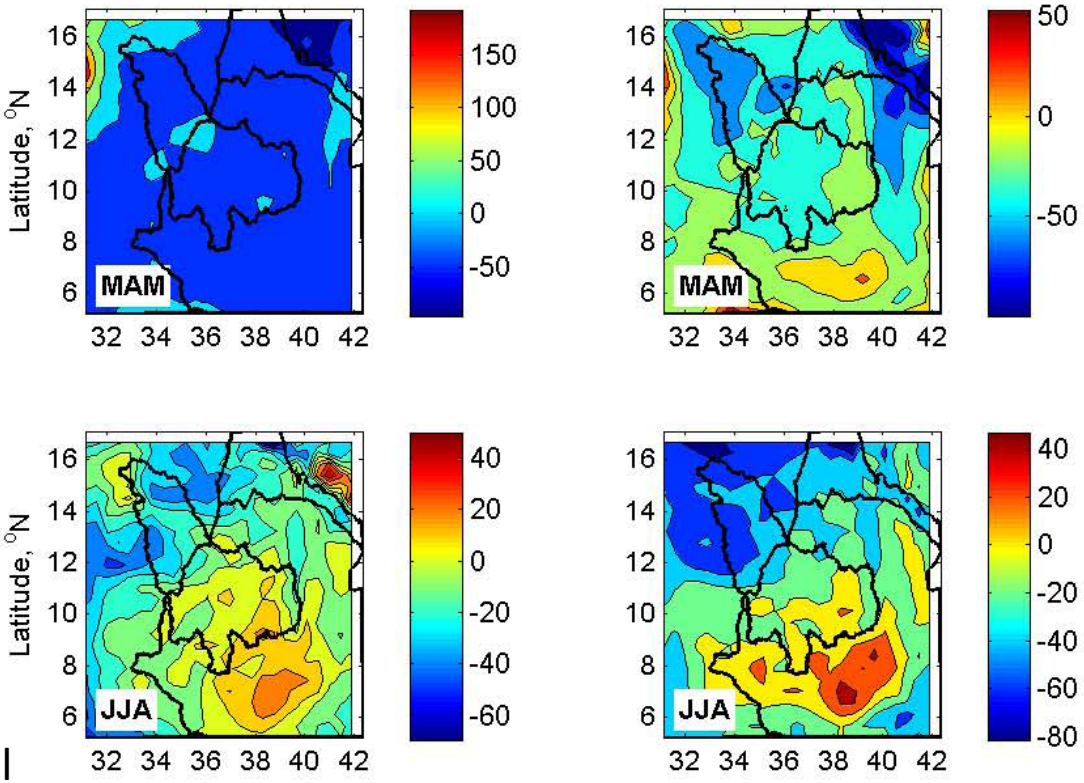
IWMI Celebrating 25 years 1985-2010

Climate Modeling (Blue Nile and Volta)

Downscaling (PIK)

- Dynamical climate models: CCLM and REMO (both for A1B scenario)
- Statistical climate model: WettReg (for A1B, A2 and B1 scenarios)

2030s – 1990s

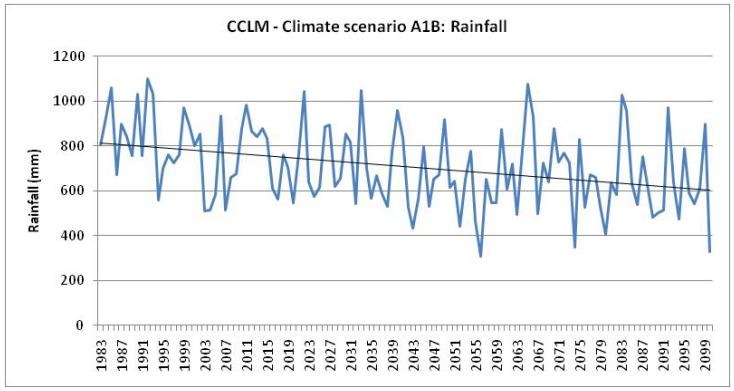


2090s – 1990s

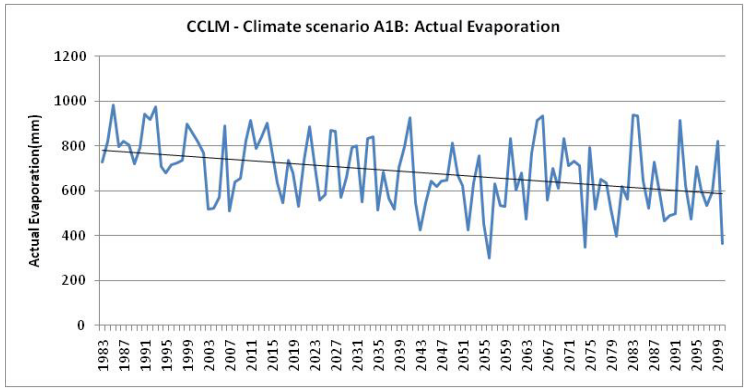
RCM – Nile rainfall

Hydrological Modeling (SWAT)

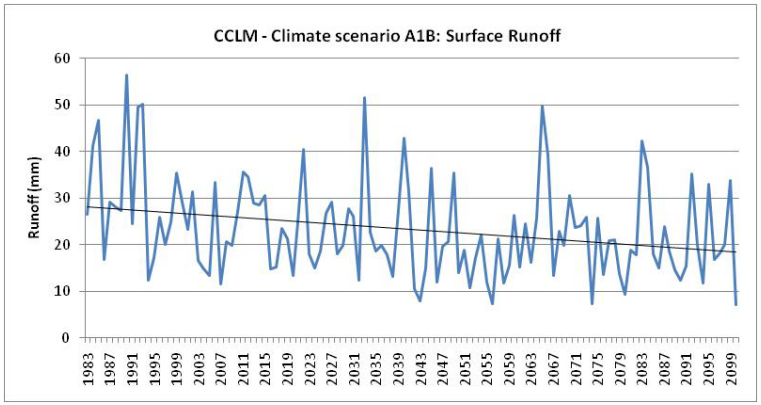
Rainfall-Runoff simulation to determine impacts of CC on flow regimes and groundwater recharge



Rainfall



Evapotranspiration

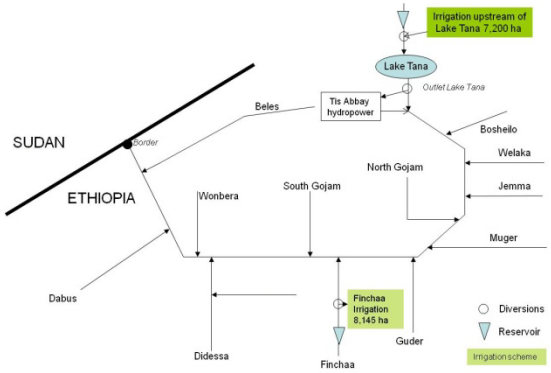


Runoff

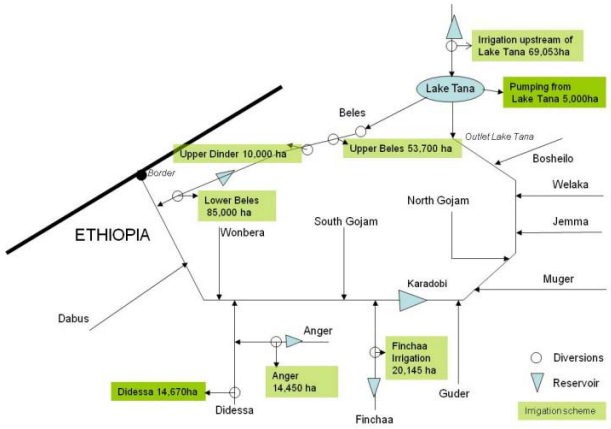
Results – one scenario (A1B), one sub-catchment in the Volta

Water Resource Modeling (WEAP)

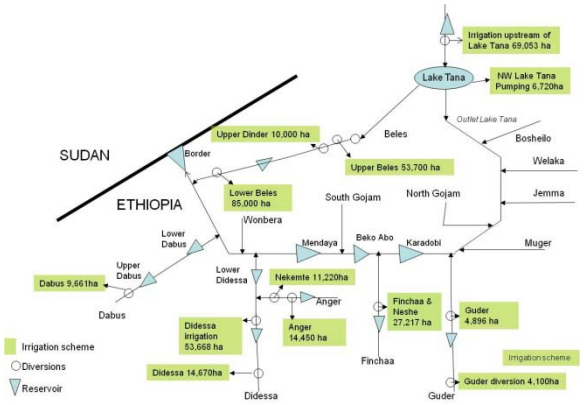
- Water Evaluation and Planning (WEAP) Model at basin level and selected sub-catchments
- Water accounting model (mass balance) – optimizes water use (monthly time-step)



Current



Near future



Distant future

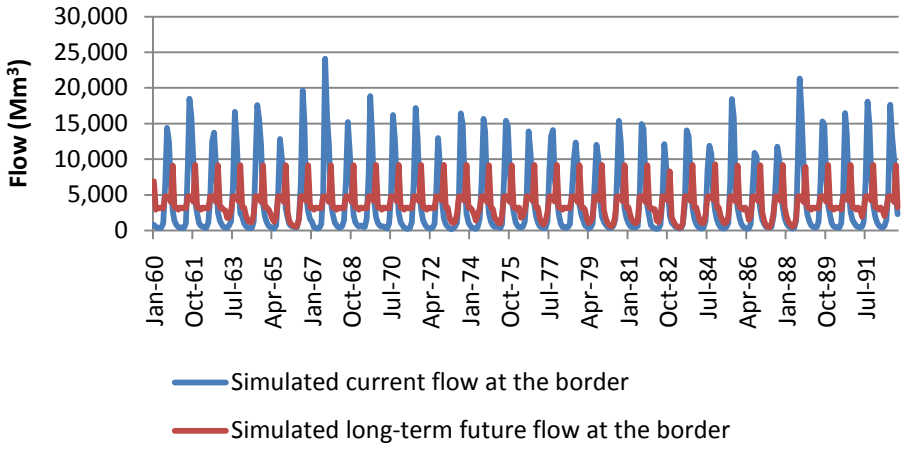
IWMI International Water Management Institute

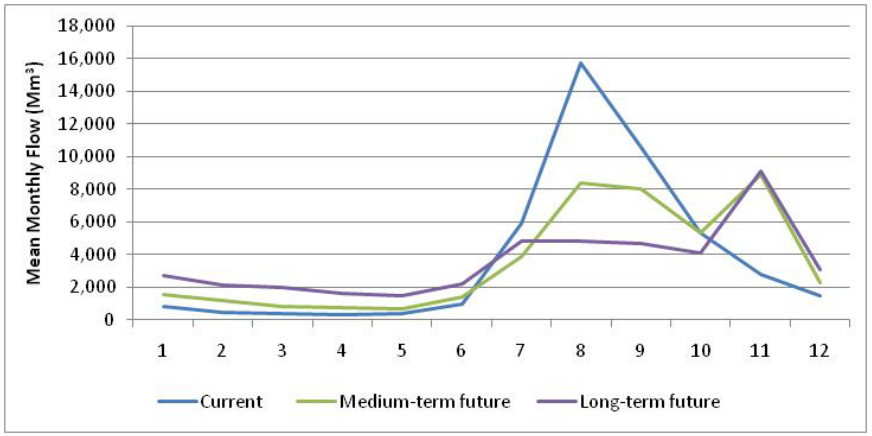
IWMI Celebrating 25 years 1985-2010

WEAP results – Blue Nile basin

Water Resource development
Existing and planned schemes

	Current	Near future	Distant future
Irrigation (ha/Bm^3)	10,000 (0.2)	210,000 (3.65)	451,000 (5.13)
Hydropower (MW/GWhy^{-1})	218 (1,383)	2,194 (12,908)	6,426 (31,297)
Storage (Bm^3)	11.5	56.8	~160





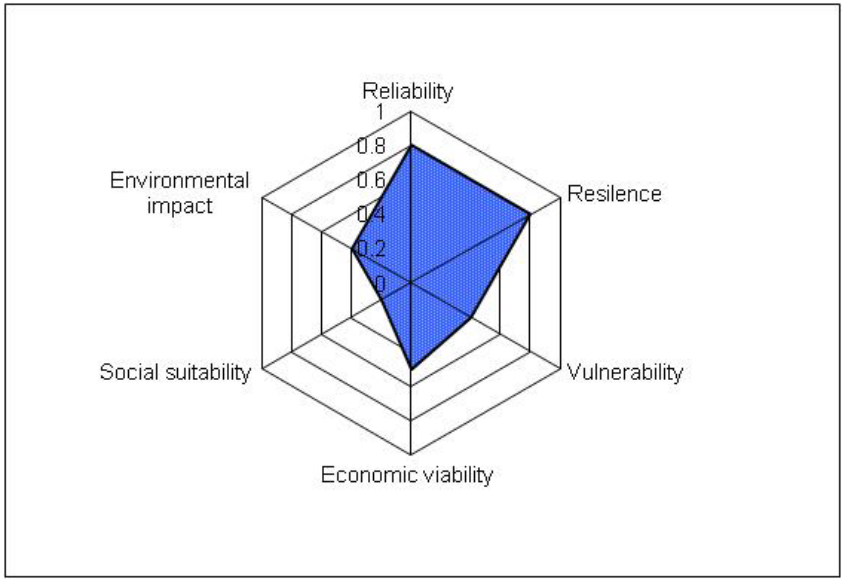
IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

Evaluation metrics

Evaluation metrics to determine

- The **need** for water storage
- The **effectiveness** of different options
- The **suitability** of different options



Key messages

- Rainfall variability is an important factor in development and translates directly into a need for water storage.
- In the past, water resource planning has tended to focus on large dams but dams are just one of a range of possible water storage options.
- The storage type to be used in any given location must be fit for purpose.
- All have costs as well as benefits and in any given location the poverty reducing impact of different water storage options varies.
- Storage systems that combine different types are generally better than individual options.
- There is no perfect combination of storage options, there will always be trade-offs

IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

Thank you

Project homepage:
http://africastorage-cc.iwmi.org/Default.aspx

IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010