

Groundwater and climate change in Africa: *The Kampala Statement*

Richard Taylor

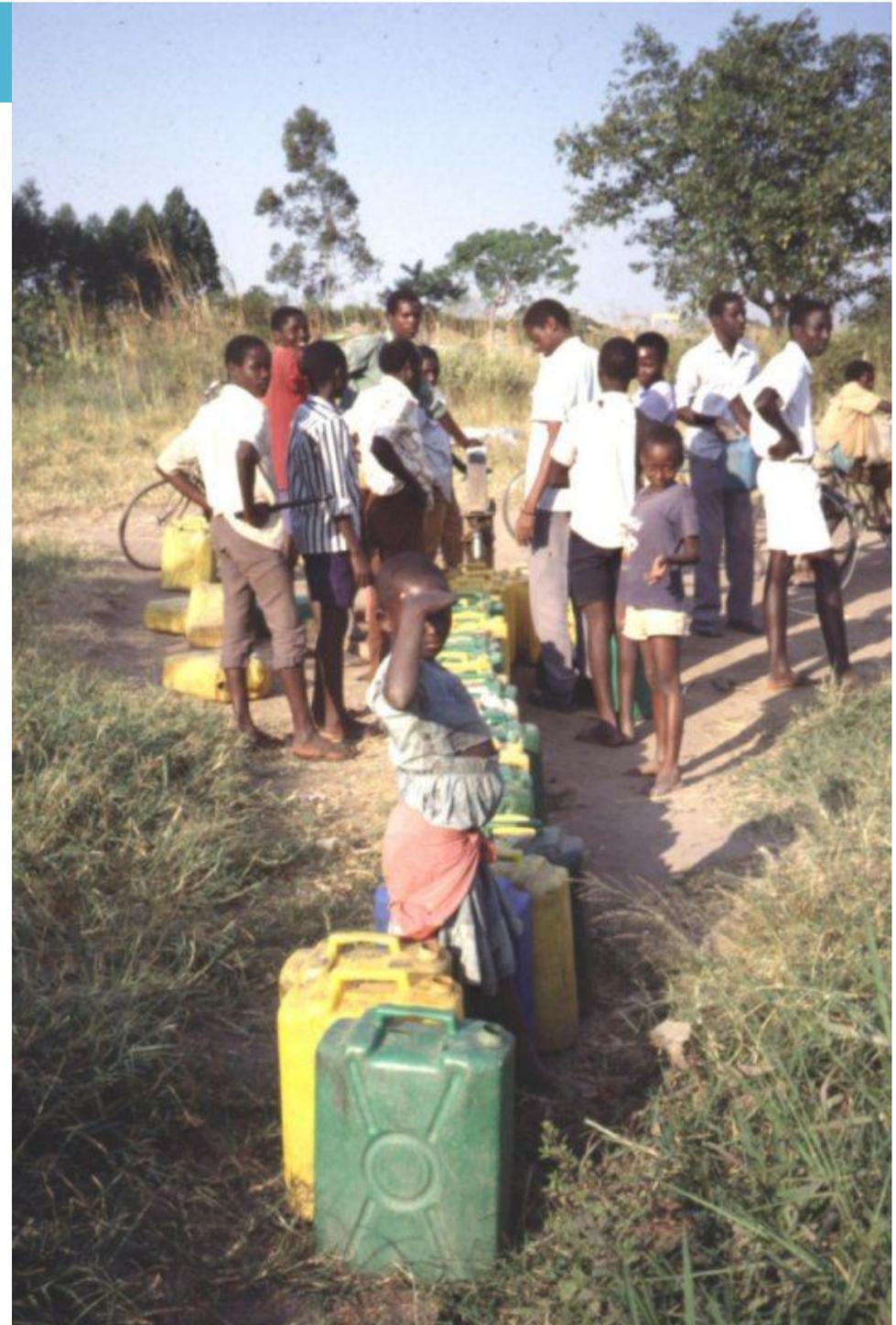
University College London (UK)

IAH Commission of Groundwater & Climate Change

www.iah.org

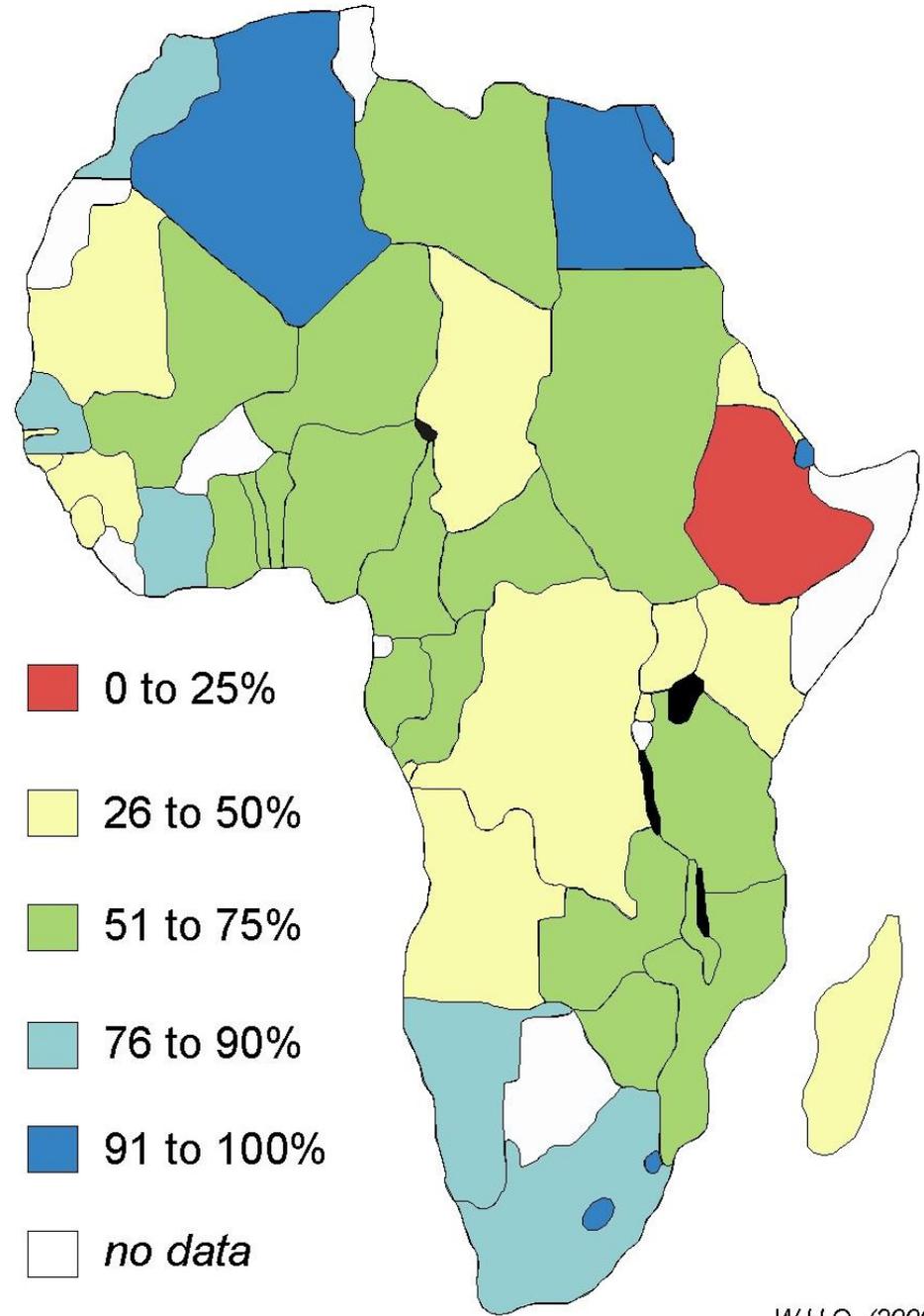
UNESCO-IHP GRAPHIC programme

<http://www.unesco.org/water/ihp/graphic/>

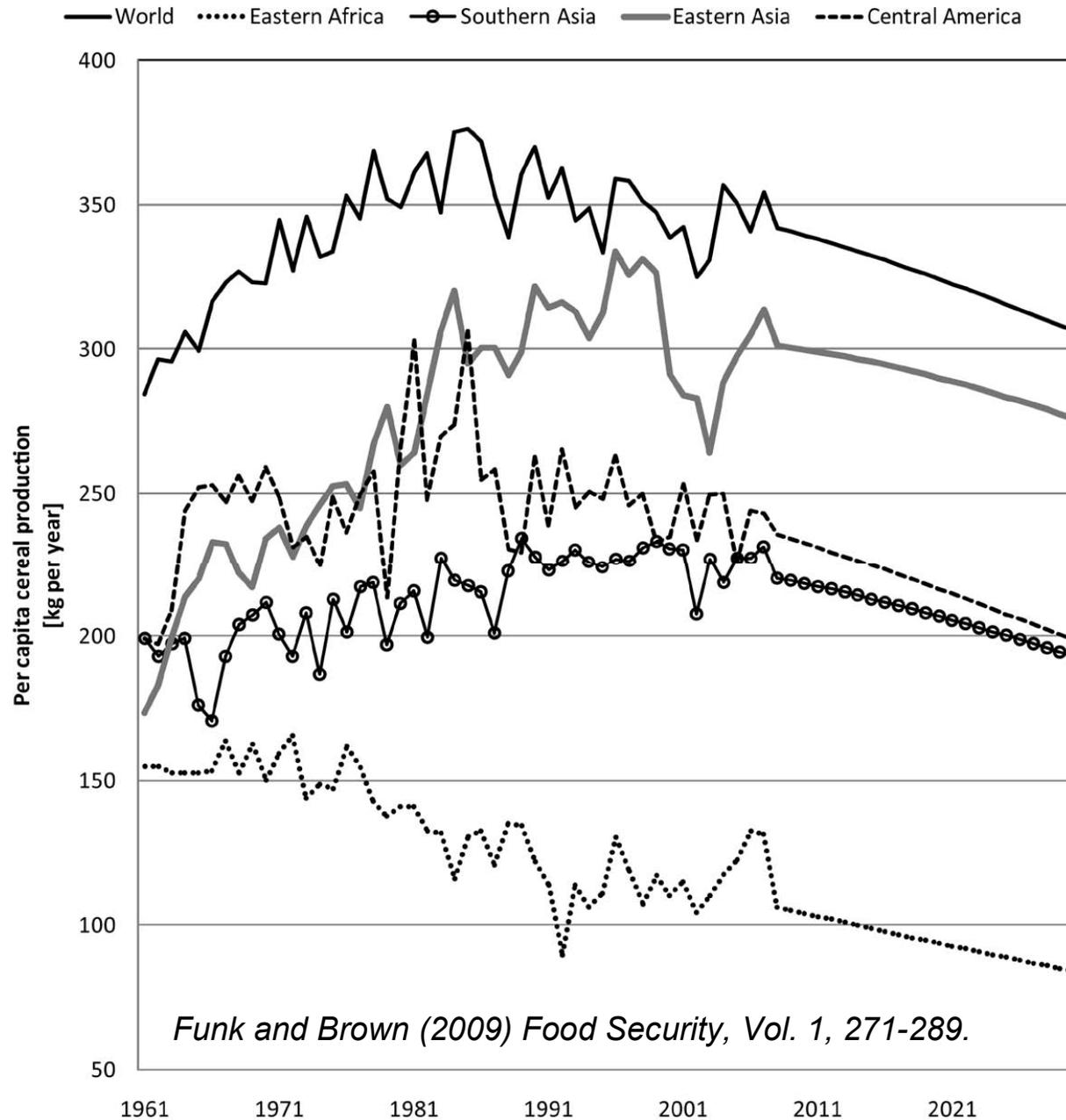




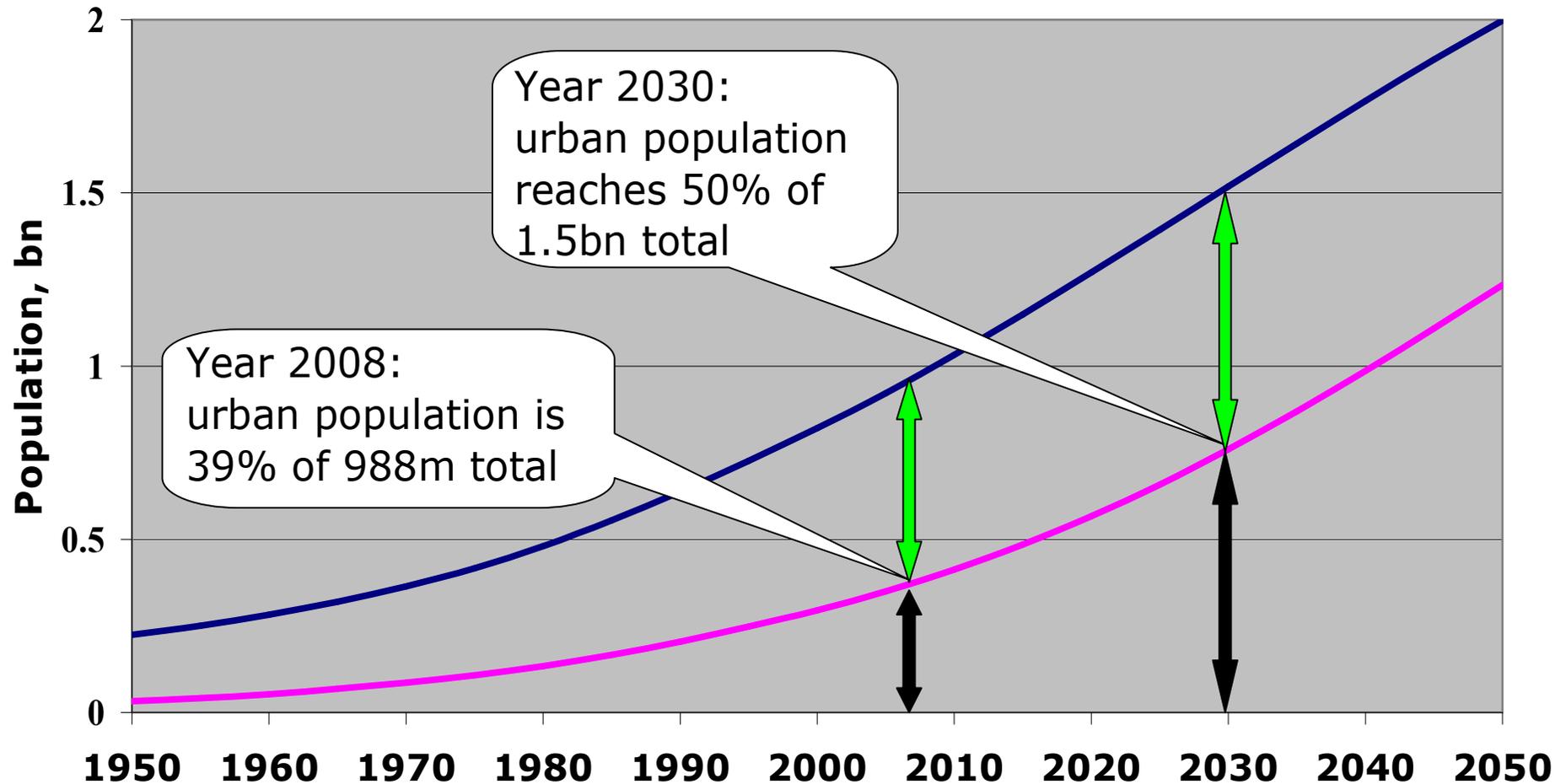
% access to safe water in 2000



declining per capita food production in Africa



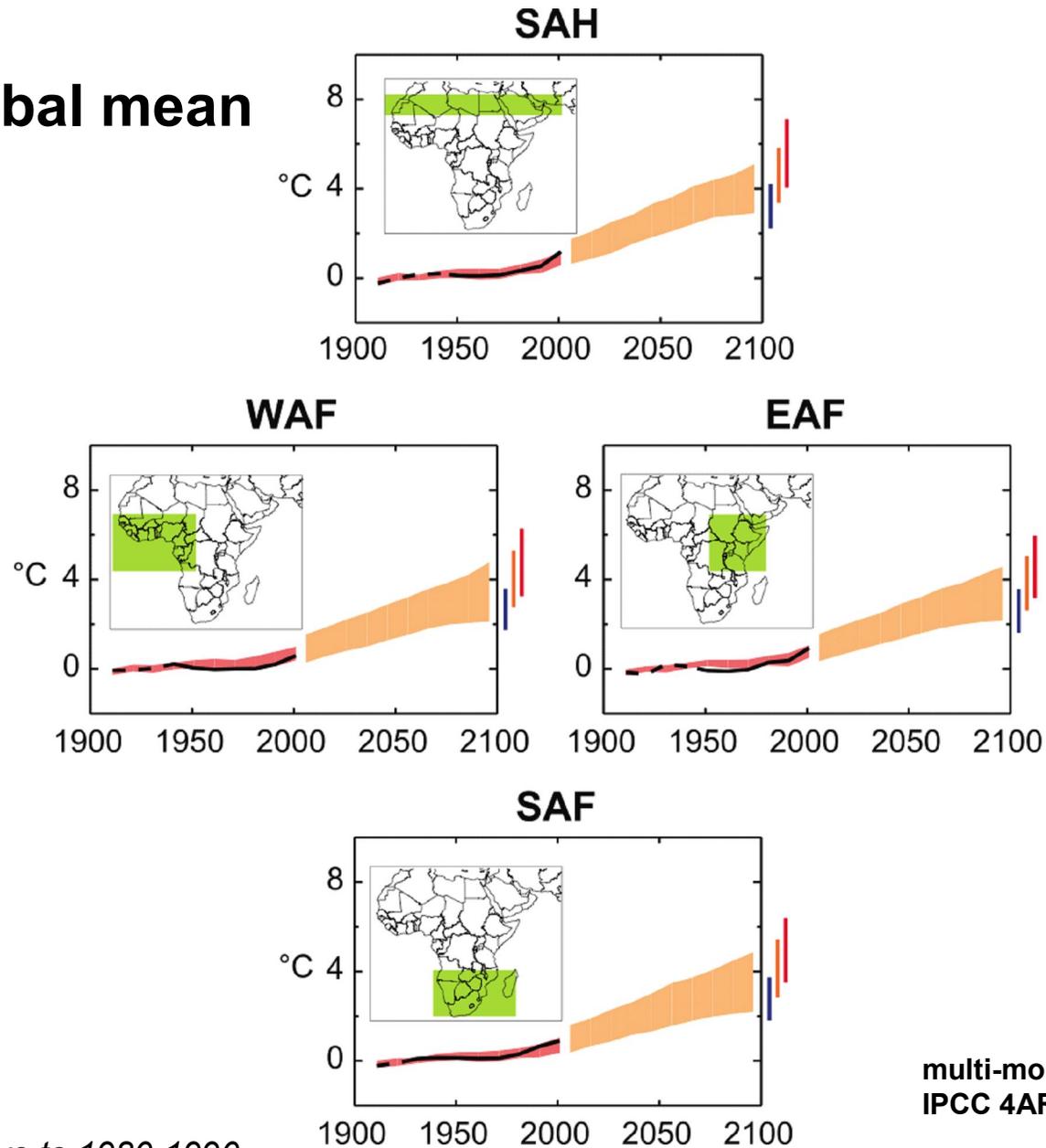
fast growing and urbanising populations



Population Division, UN DESA (2007)

projected warming in Africa of 3 to 4°C this century

1.5 X global mean



multi-model ensembles
IPCC 4AR Figure 11.1

* 2080-2099 relative to 1980-1990

uncertain projections of rainfall

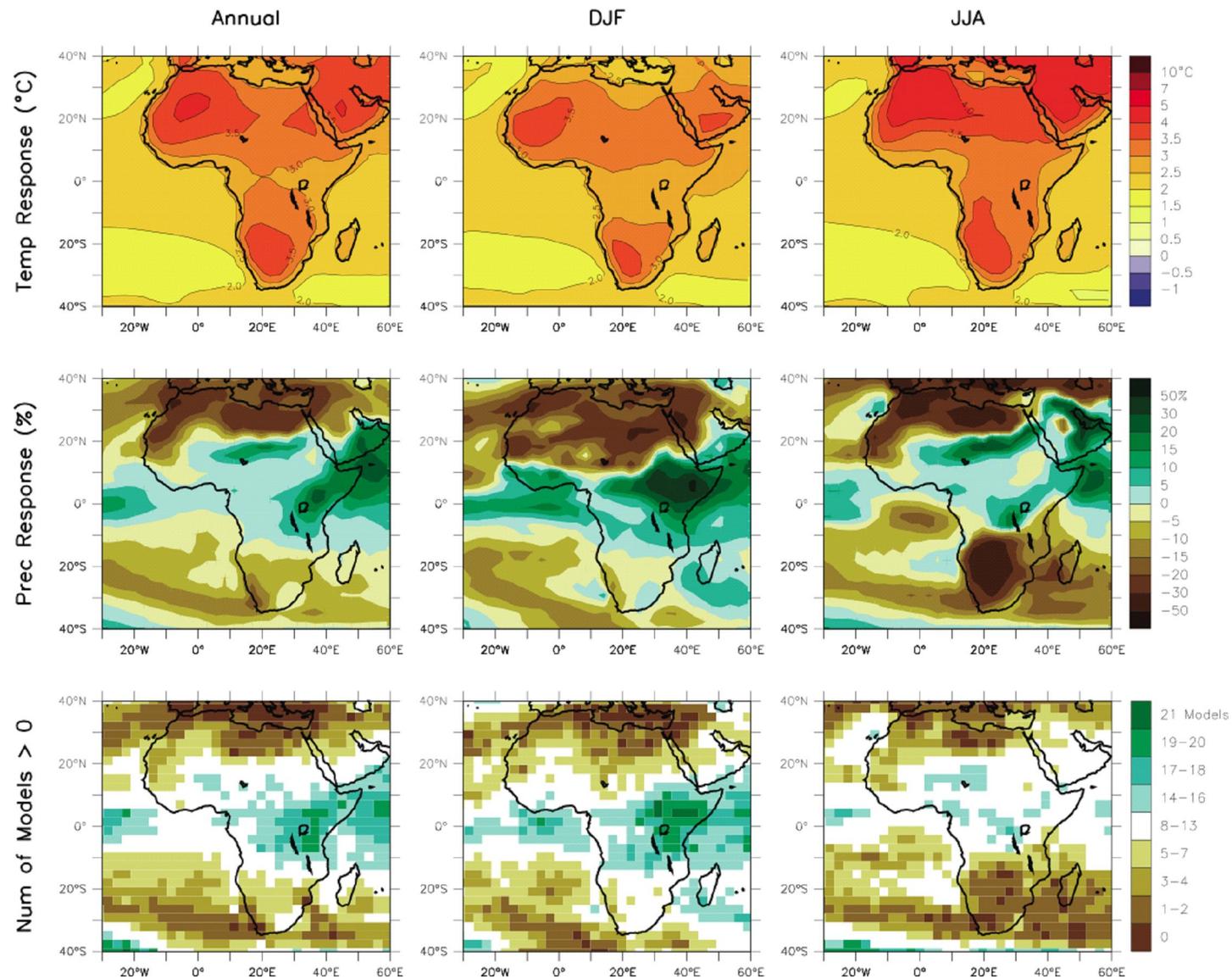


Figure 11.2

multi-model ensembles IPCC 4AR (A1B scenario)

variability in African rainfall

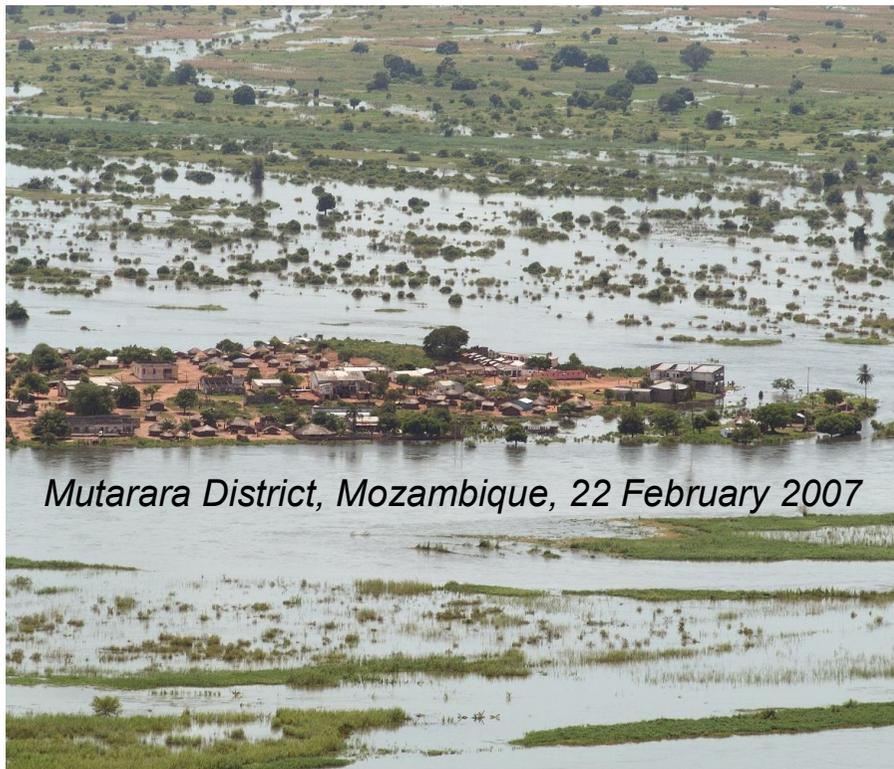
- most variable river discharge in the world
- variability to increase with global warming
 - *more frequent and intense floods & droughts*

McMahon et al., 2007. J. Hydrol. 54, 727-738.

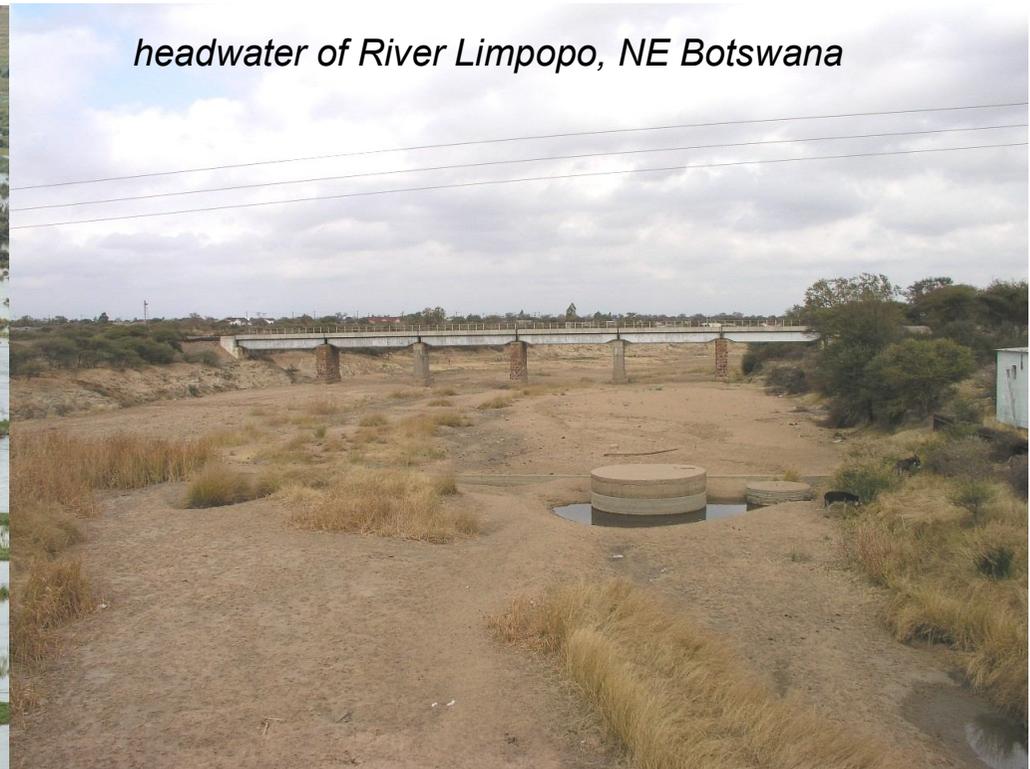
Allen and Ingram, 2002. Nature 419, 224-230.

Trenberth et al., 2003. BAMS 84, 1205-1217.

Mileham et al., 2009. Hydrol. Sci. J. 54, 727-738.



Mutarara District, Mozambique, 22 February 2007

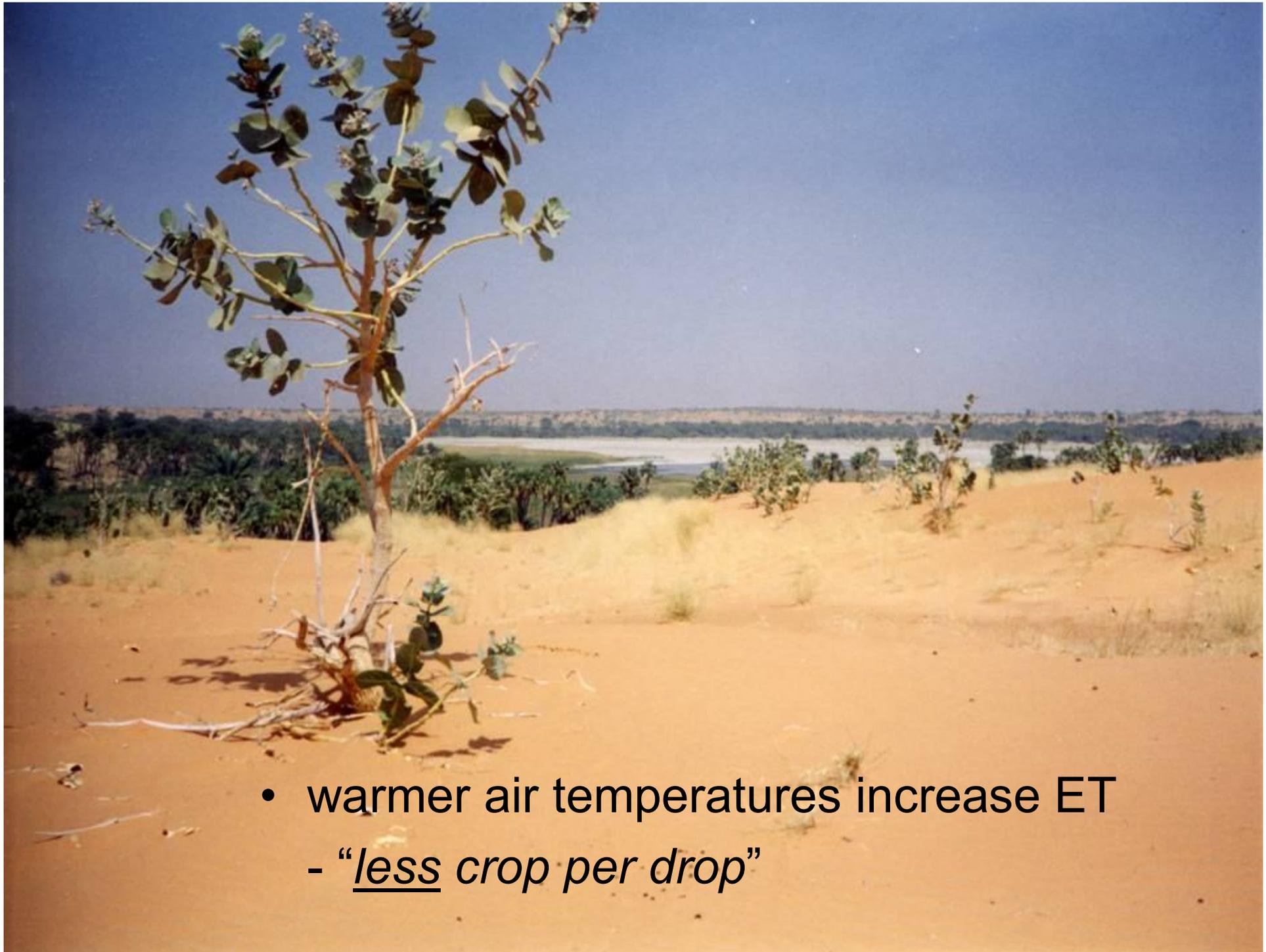


headwater of River Limpopo, NE Botswana

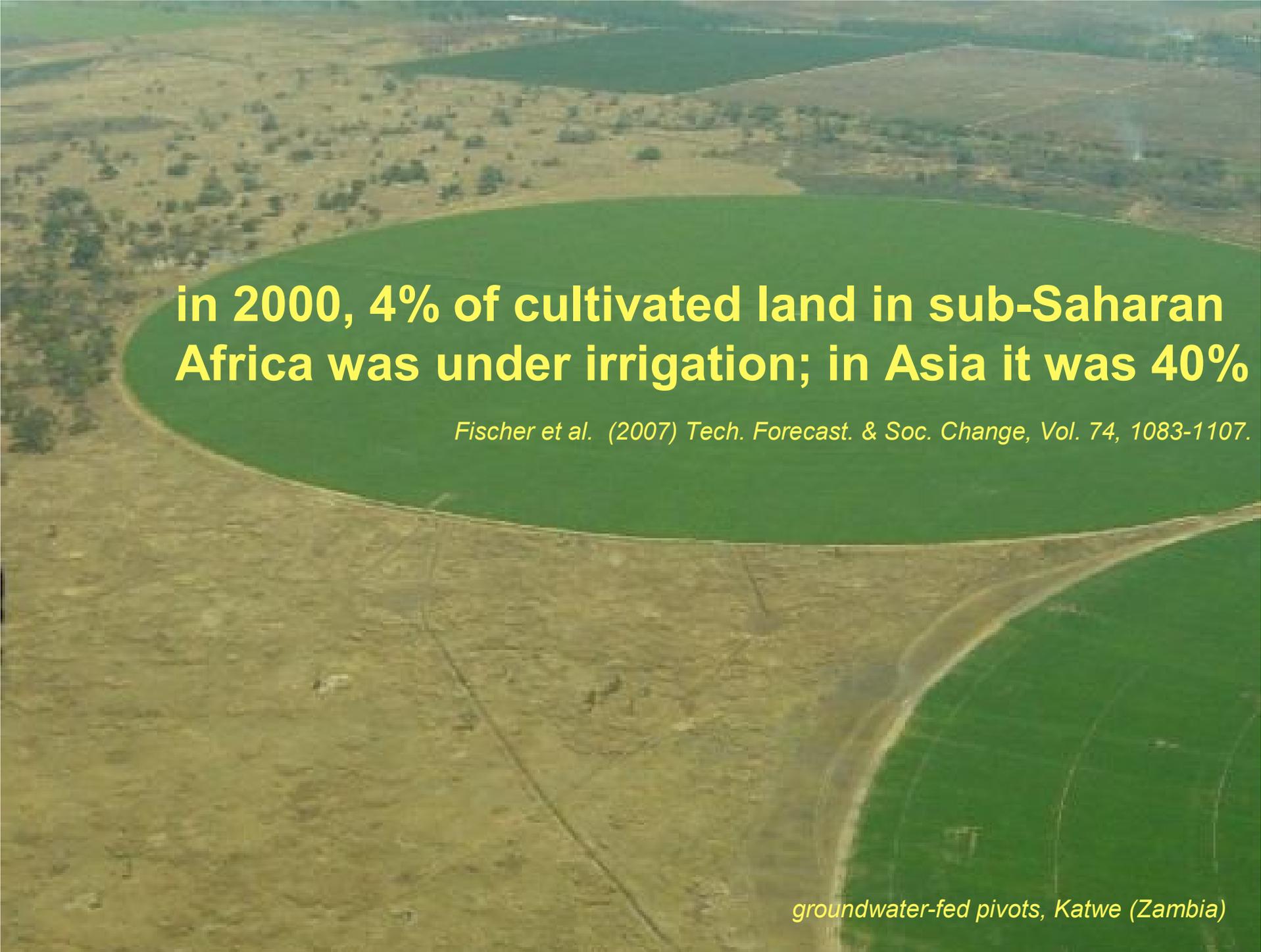
- more variable precipitation leads to more variable soil moisture reducing crop yields *Challinor et al. 2006. "Avoiding Dangerous Climate Change", pp. 187-194.*
- climate change threatens food security as >95% of all food grown in sub-Saharan Africa is rainfall-fed



matoke and tea plantations, Bushenyi (Uganda)



- warmer air temperatures increase ET
 - “less crop per drop”



in 2000, 4% of cultivated land in sub-Saharan Africa was under irrigation; in Asia it was 40%

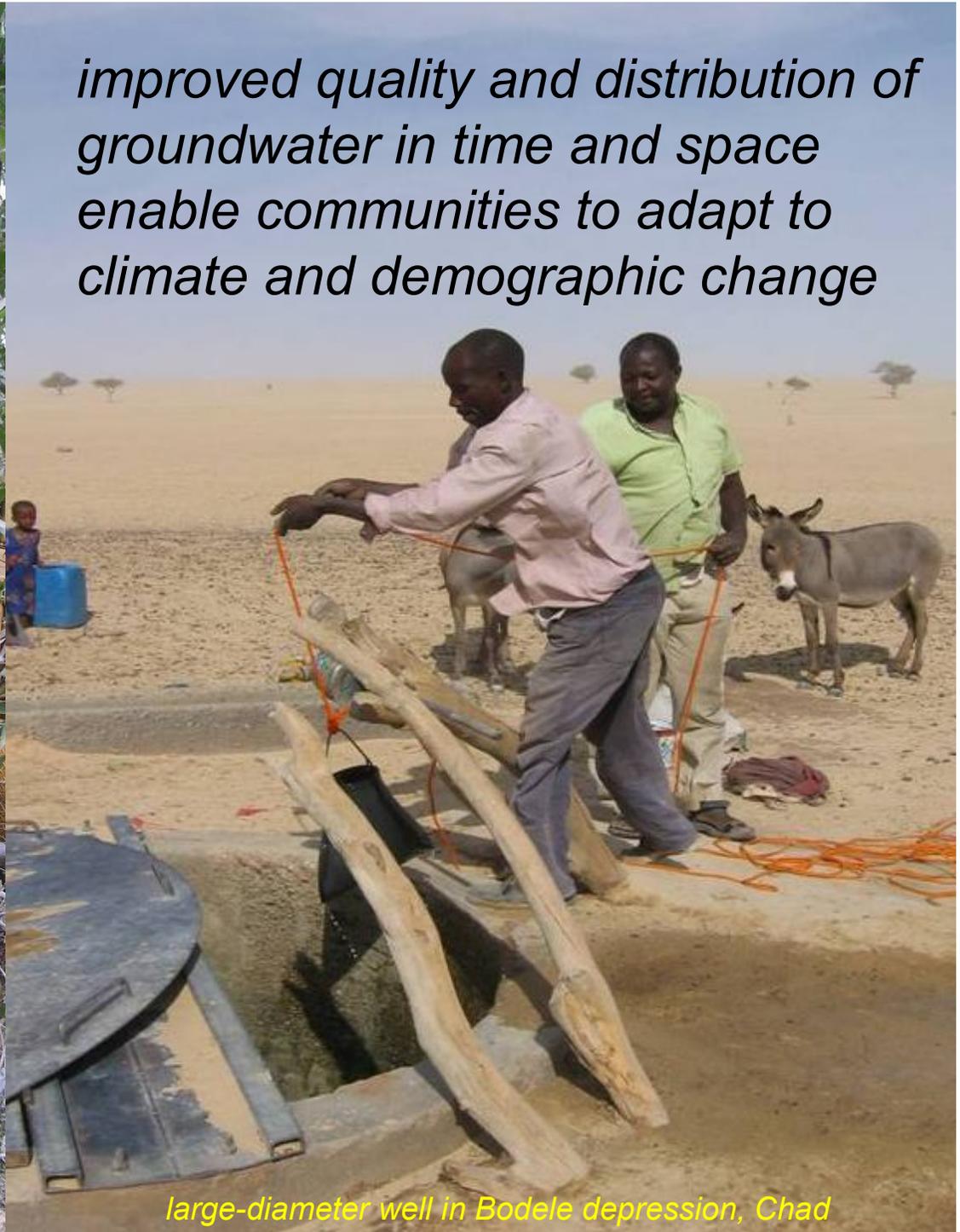
Fischer et al. (2007) Tech. Forecast. & Soc. Change, Vol. 74, 1083-1107.

groundwater-fed pivots, Katwe (Zambia)

improved quality and distribution of groundwater in time and space enable communities to adapt to climate and demographic change



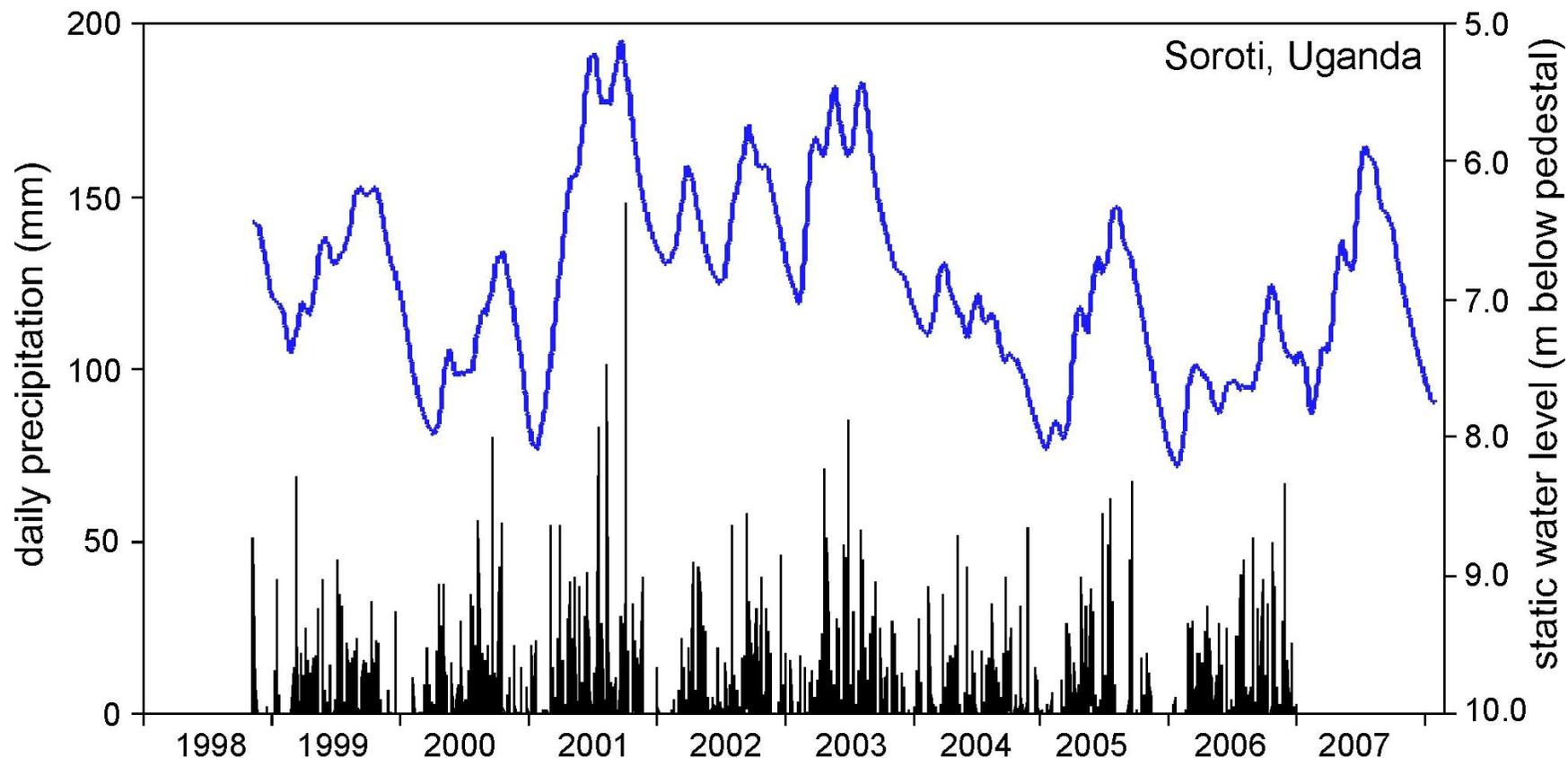
water-well drilling in Rukungiri, Uganda



large-diameter well in Bodele depression, Chad

projected increases in rainfall intensity favour groundwater recharge (Uganda, Nigeria)

Taylor & Howard, 1996. J. Hydrol. 180, 31-53.
Eilers et al., 2007. Geoderma. 140, 119-131.
Mileham et al., 2008. J. Hydrol. 359, 46-58.
Owor et al., 2009. Environ. Res. Lett., Vol. 4.



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- renewable groundwater resources in sub-Saharan Africa are ~2X China and ~4X India FAO (2003) AquaStat
 - *enormous potential of groundwater to improve access to safe water at low cost...*

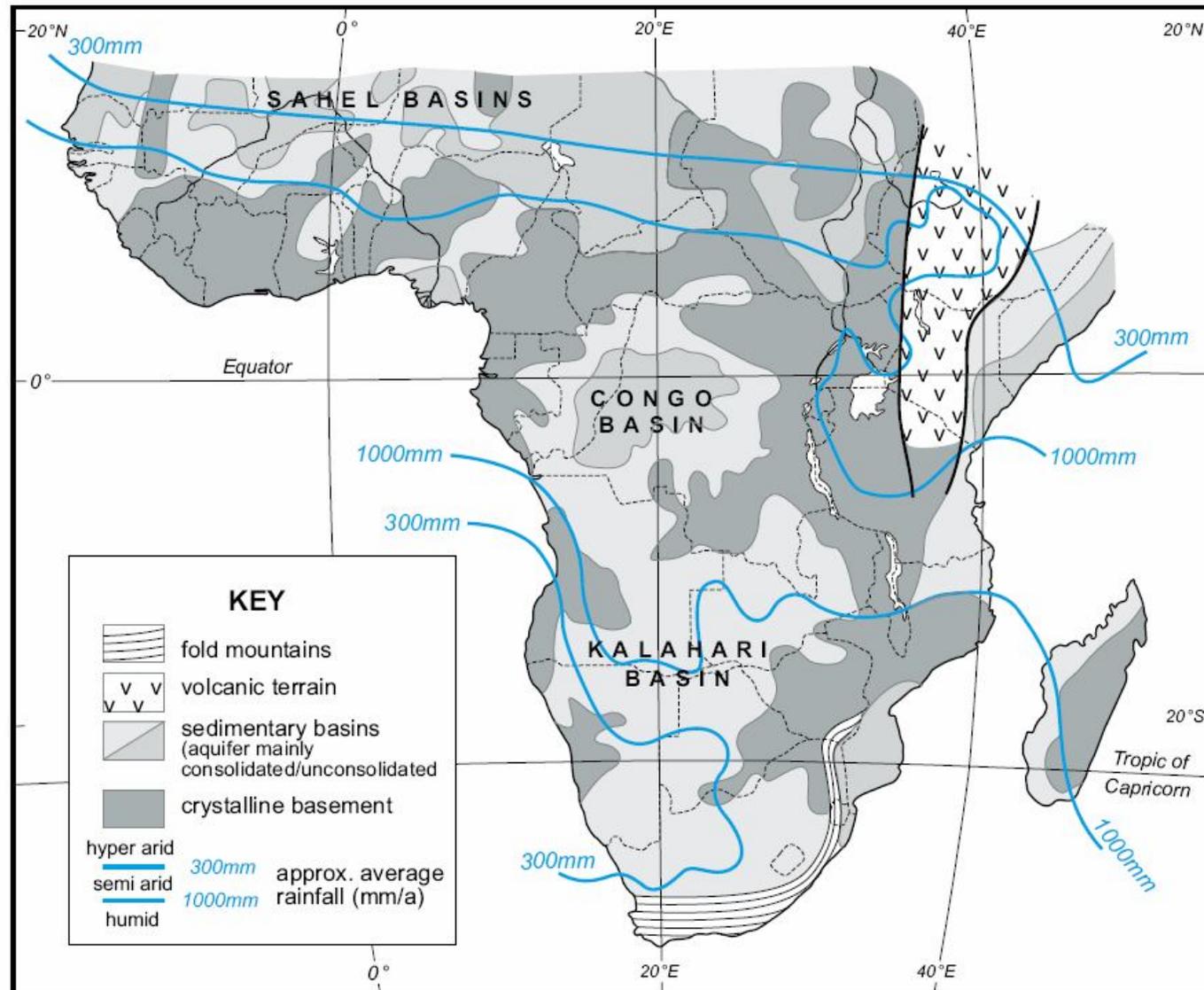
*urban spring
Kampala (Uganda)*

and to improve food security and expand food production through groundwater-fed irrigation



*maize plantation irrigated by a groundwater-fed pivot
Katwe (Zambia)*

- considerable uncertainty in groundwater resources and the sustainability of more intensive groundwater development



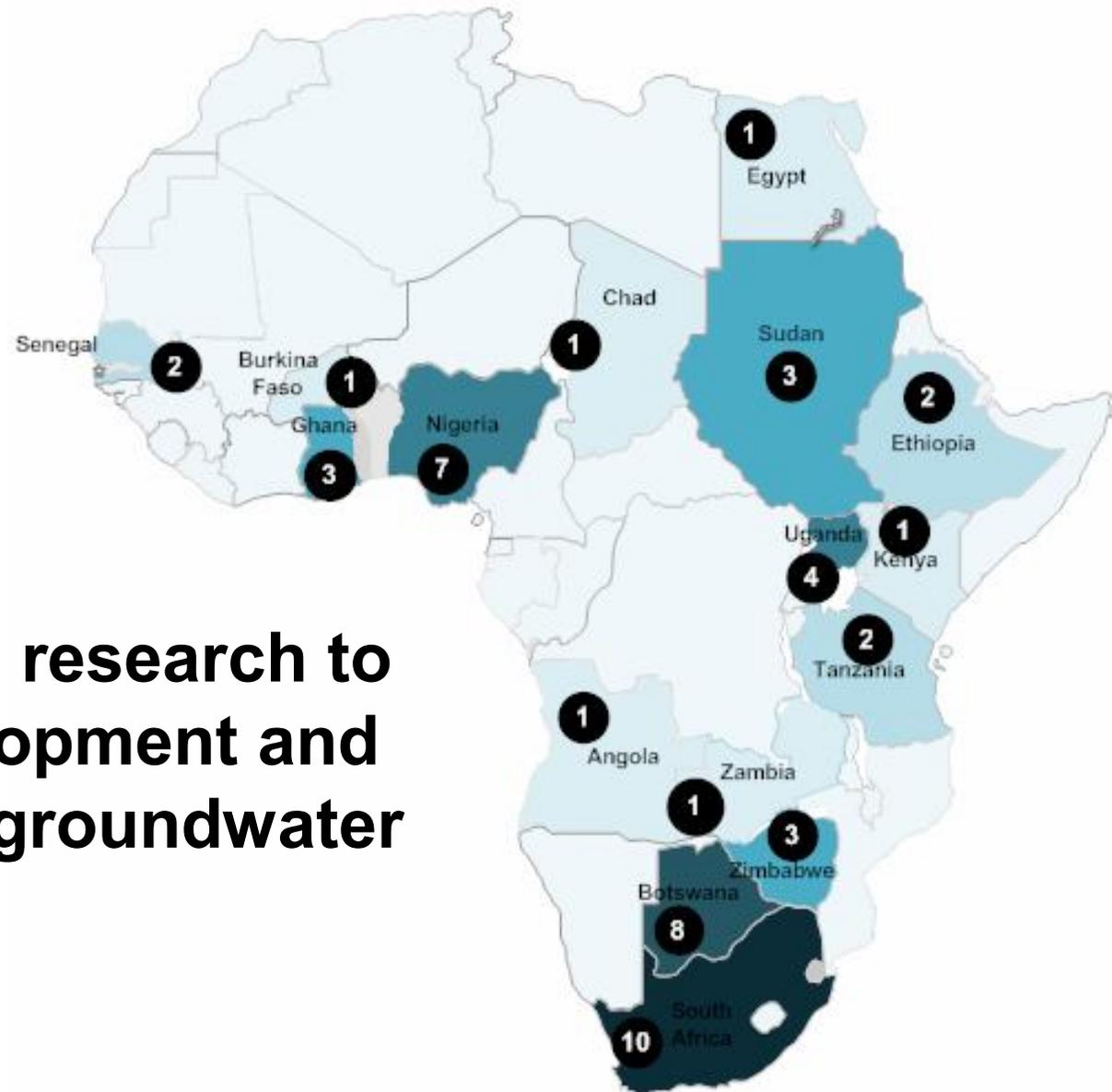
- **need to invest in training**



- **need to invest in monitoring & assessment**



quantitative studies of groundwater recharge in Africa



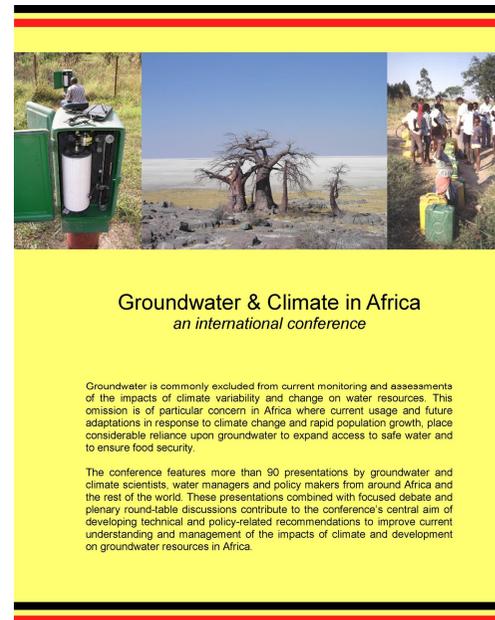
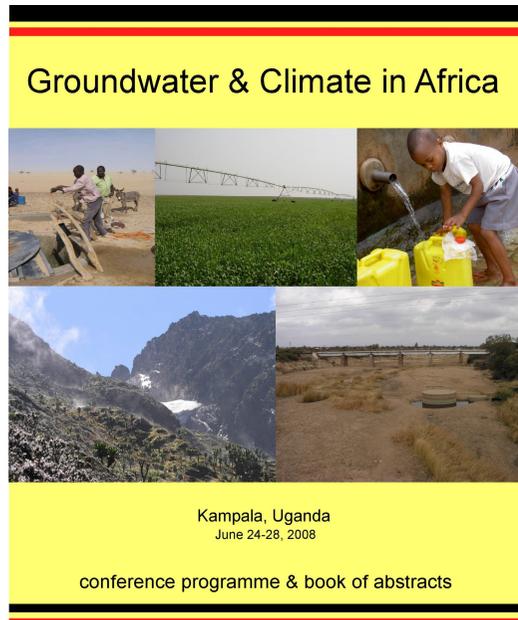
- **need to invest in research to inform the development and management of groundwater**

Summary:

1. great potential for groundwater to enable communities in sub-Saharan Africa to adapt to projected changes in freshwater availability brought about by climate change and demographic change (at low cost)
2. urgent need for the development of *learning alliances* and investment in people and infrastructure to overcome current barriers to the sustainable use of groundwater

groundwater-fed pivots, Katwe (Zambia)

24 to 28 June 2008, www.gwclim.org



- representatives from 23 countries in Africa (37 in total)
- 96 presentations published in *IAHS Red Book Vol. 334* & *special issue of Hydrological Sciences Journal Vol. 54(4)*
- policy outcomes summarised in “*The Kampala Statement*”