

# *Watering Africa's Sleeping Giant?*

*June 21-22 2010*



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## Sleeping Giant report - irrigation

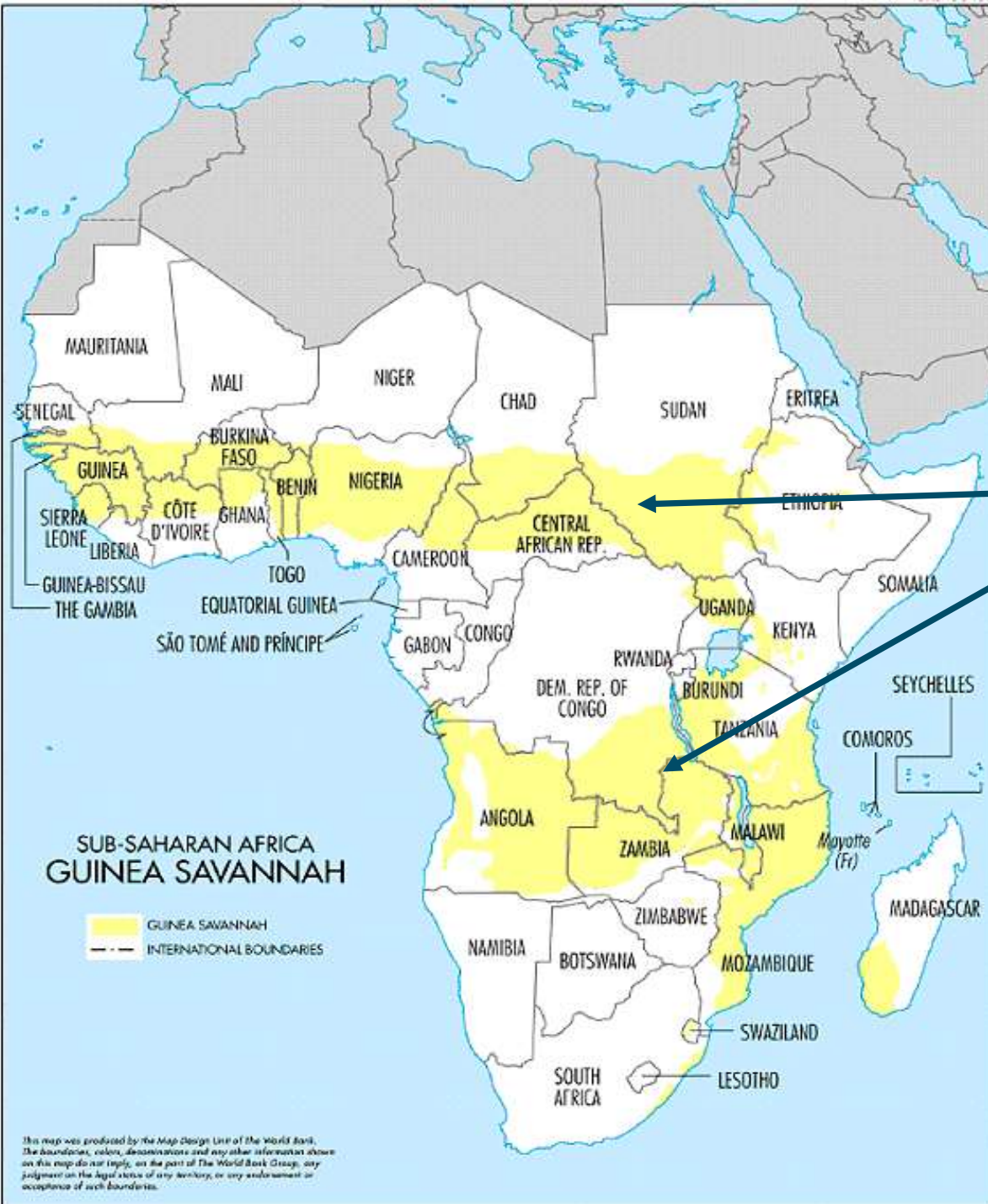
- ✦ Irrigation potential. P119: “In Nigeria, even though lack of water is a major constraint to production, the country’s vast irrigation potential remains largely unexploited.”
- ✦ Water resources plentiful in Mozambique, Zambia, Nigeria? P170-171:
- ✦ Variability in rain and river supply = feature of semi-arid environs, plus climate change will increase variability and decrease predictability
- ✦ Environmental problems (salinisation, impacting water resources – withdrawals; agrochemicals, siltation)

**Sleeping Giant report - *Priorities for public investment. Science and technology.***

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✦ **“Irrigation.** Although the development of commercial agriculture in Africa likely will be driven by rainfed farming, there is an important role for small-scale and supplementary irrigation to extend the cropping season and ensure against climatic risks, especially in the drier parts of the Guinea Savannah. Recent successes with small-scale irrigation (for example, in Nigeria and Malawi) show that this can be done”. [p186]

✦ **Agreed : good summary!**



Seek  
pockets of  
irrigation  
success

## Sleeping Giant report - irrigation

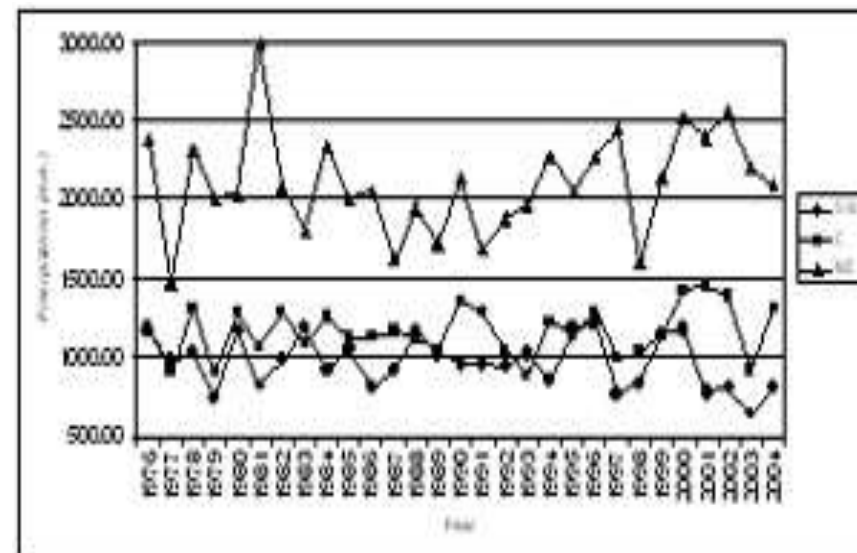
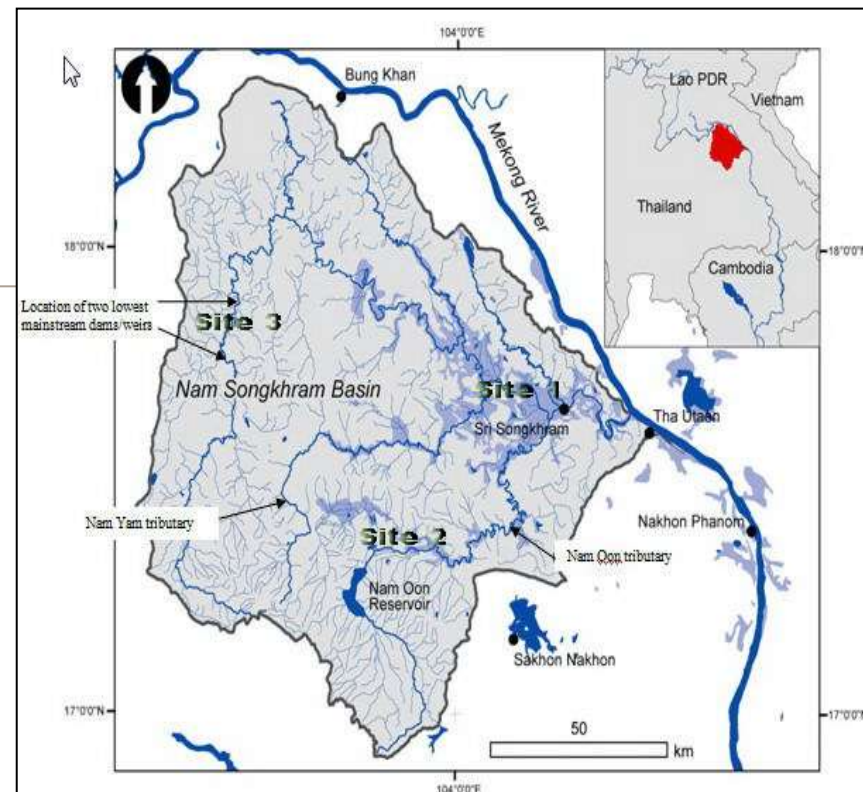
- ✦ Yes, irrigation will play a role
- ✦ There are success stories from around SSA
- ✦ There is potential in many basins for more irrigation utilising both ground and surface water.
- ✦ However care is needed:
  - ✦ The environment is semi-arid & highly variable, unpredictable
  - ✦ Groundwater and power/energy is intermittent
  - ✦ Donor vs farmer views on technologies & costs
  - ✦ Little expertise in advisory groups on tech' and inst' issues
  - ✦ Lack of administrative reach / fiscal constraints
  - ✦ Many thousands of farmers collectively influence water patterns
  - ✦ Role of private sector in attractive market & political economy
  - ✦ If grain/carbohydrate/oilseed field crops are our focus
- ✦ Questions on how/extent of irrigation support and water allocation between sectors (env, power, urban)



# Semi-arid NE Thailand

- ✦ Single nation; irrigationism
- ✦ Smallholder culture
- ✦ *Hydraulic* Royal Irrig Dep.
- ✦ Greater storage
- ✦ Lam Nam Oon canal irrigation: 32,480 ha
- ✦ 900-1100 mm average P
- ✦ Salinisation on the rise

(With thanks to PhD student David Blake)



# Brazil Cerrado

- ✦ Semi-humid averages range 800-1600 mm P/ 1100-1600 mm P / 1250-2000 mm P
- ✦ Rainfed, supplementary irrig
- ✦ Technologically rich – mainly via centre pivot & drip = offering water control
- ✦ “Small-scale pumping operations” (p118) – in SSA technically large



With thanks to Edmilson Teixeira and PhD student Marcos Lopes

# 'Irrigation potential' narratives

## Overplayed in Sub-Saharan Africa

- ✦ “In Nigeria, the country’s vast irrigation potential remains largely unexploited. Between 2 million and 2.5 million hectares are considered potentially irrigable, but currently only about 290,000 hectares are under irrigation, representing less than 1 percent of the cropped area”
- ✦ “In Zambia, estimates of the technically irrigable area range as high as 500,000 hectares. Thus far, only about 150,000 hectares have been developed for irrigation, predominantly on large commercial farms”. [p119]



# 'Irrigation potential' narratives

- ✦ Tanzania irrigation potential is 2.1 million ha. (2002 National Irrigation Master Plan). Criteria: are water resources potential, land resources potential and socio-economic potential.
- ✦ Yet 20,000 ha in Pangani and Ruaha basins → closed
- ✦ Critically canal-fed savannah irrig: area 0.5x to 2.0x
- ✦ Variable water withdrawals
- ✦ Neglects the dry season 'containing' of irrigation
- ✦ Risks for downstream users in dry periods

# ‘Irrigation control’ narratives

- ✦ “Irrigation may not be as critical in the Guinea Savannah as in other more arid production environments, but the potential contribution of irrigation to African agriculture should not be underestimated. **Commercial farmers in southern Africa have long known that even a single preplanting irrigation can make an enormous difference in enabling timely planting and ensuring that crops get off to a vigorous start, which can significantly affect eventual yields and reduce risks**” (p119)
- ✦ But this requires considerable control over water over space, assessed by *dose and timing*, at different scales (field to basin)

## Structured canal schemes



10,000 ha: one intake



Cane estates in Swaziland

## Pressurised systems



10-3000 ha per system



Centre pivot, Nile Delta



## Bucket and small pumps



0.2 ha per family group



Valley bottom/wetland irrig.  
Pongola floodplain, SA

## Smallholder-owned systems

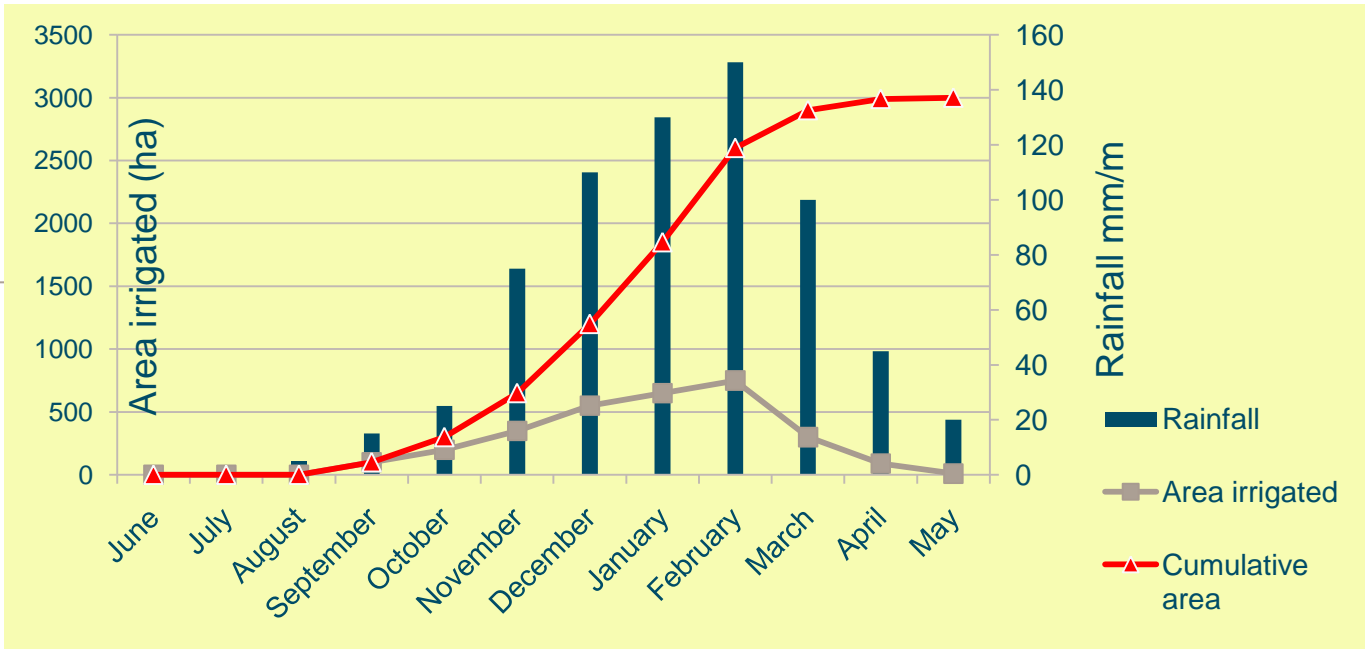


10 to 3000 ha per intake

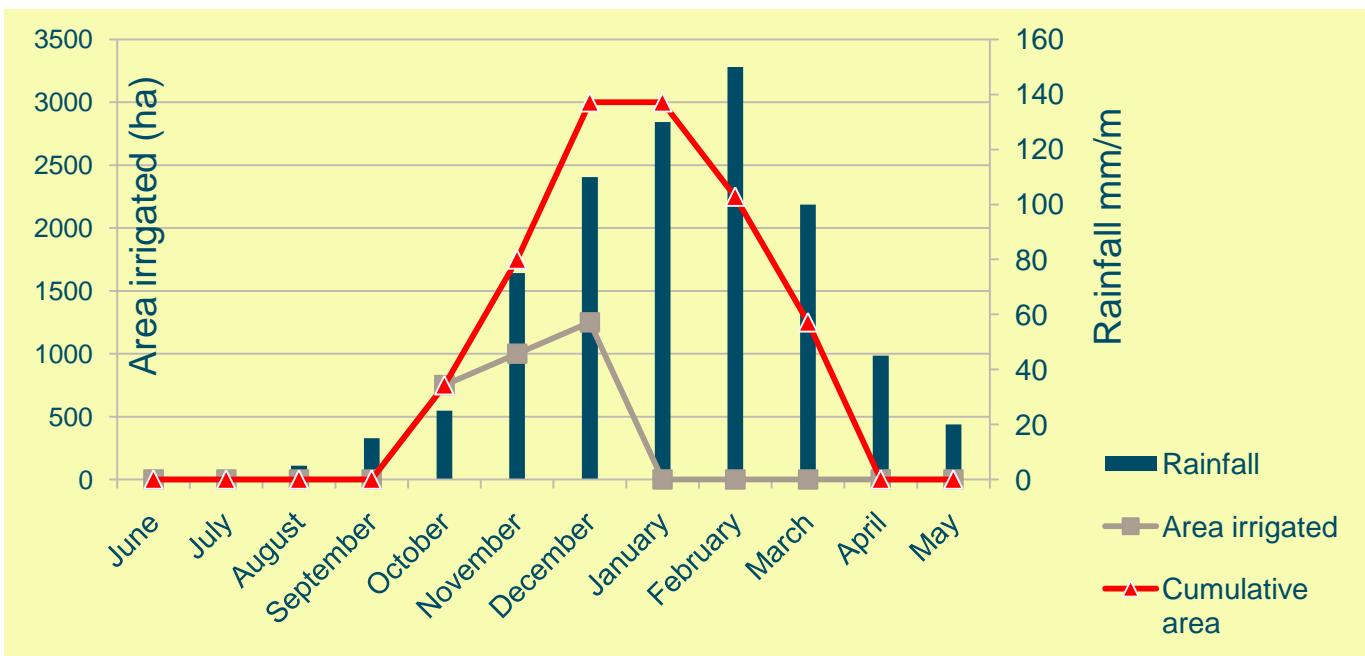


Smallholder paddy system,  
Usangu, Southern Tanzania

Gravity smallholder irrigation; rate of coverage depends on run of river supply & upstream users cascading supply or cessation of demand. Vulnerable to breaks in rain & and seasonal yield decline



Pressurised irrig.; pattern of coverage depends on stored supply & design of system. Vulnerable if insufficient stored.



In both cases, total command area (3000 ha) depletes downstream users.



# ‘Small-scale irrigation, technology and storage’ narratives

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- ✦ .... some donor-supported projects have enjoyed some success in helping smallholders build dams, construct gravity-fed water furrows, and acquire treadle pumps to improve year groundwater access for both crops and livestock. [p119]

# Micro-technologies (e.g. ICRISAT “African Market Gardens”)

- ✦ Treadle work-effort equiv 0.5 ha = 0.6 million Joules/day
- ✦ Row crops – perishable veg & fruit ✓
- ✦ Near urban centres ✓
- ✦ Lift of 1-2 metres ideally; location?
- ✦ \$20-\$100 bucket kits = Cost US\$5-10K/ha
- ✦ Governance of diffuse vs point demand
- ✦ Cumulative irrig area can deplete small catchments



Treadle pumps



Micro-irrigation kits

## Micro-technologies (e.g. ICRISAT)

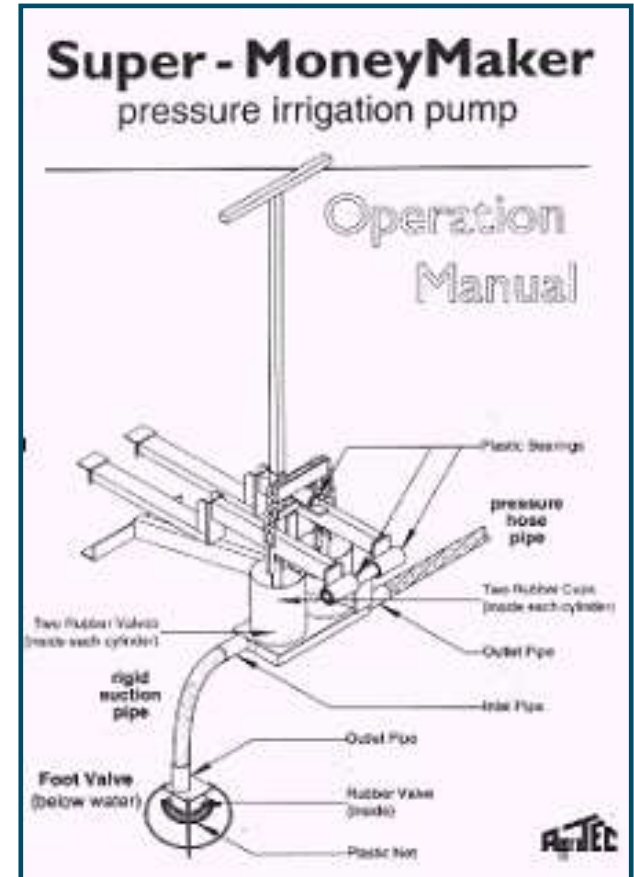
- ✦ This small demonstration plot 24 kits ~ 1000 dollars
- ✦ Replaced every three years

Critical field  
research  
required



## Micro-technologies (e.g. ICRISAT)

- ✦ Leave to private sector to sell and farmers to buy
- ✦ Should strategic aid policy and investment be subsidising such equipment rather than creating enabling conditions?





# Rainwater harvesting for agricultural productivity

Component of New Green Revolution for Africa



**Microcatchment  
Rainwater Harvesting  
Systems: Zai Planting  
Holes**

- ✦ Theory\* = manage/boost soil water storage to bridge meteorological drought.
- ✦ Yet limited uptake outside demonstration projects
- ✦ Labour, land tenure, drought/flood/soil mix
- ✦ Unlikely for field grain crops
- ✦ Not for commercialised agriculture (rapid seeding/planting/harvesting)
- ✦ Surface infiltration – zero/min/green/full till



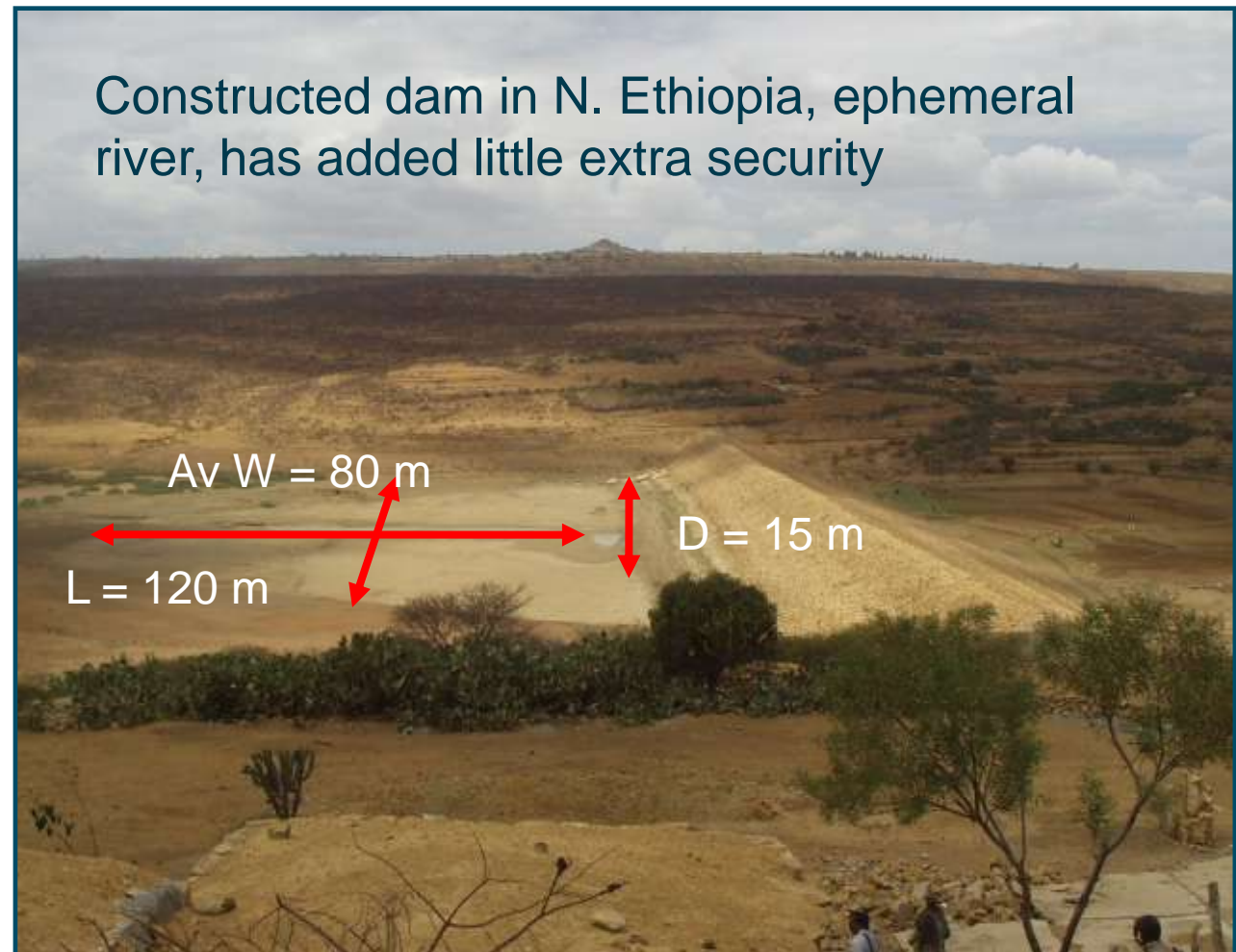
**Terraces in  
Ethiopia**

\* Managing water in rainfed agriculture—The need for a paradigm shift; Rockstrom et al AGWM 2009



# Risks that even large storage insufficient for agriculture

- ✦ Semi-arid, 8 mm/day, for 400 ha command area, dam storage lasts 4.5 days
- ✦ Semi-humid, at 4 mm/day, storage lasts 9 days, or commands double area
- ✦ At (one x 70 mm dose) = 206 ha supplied

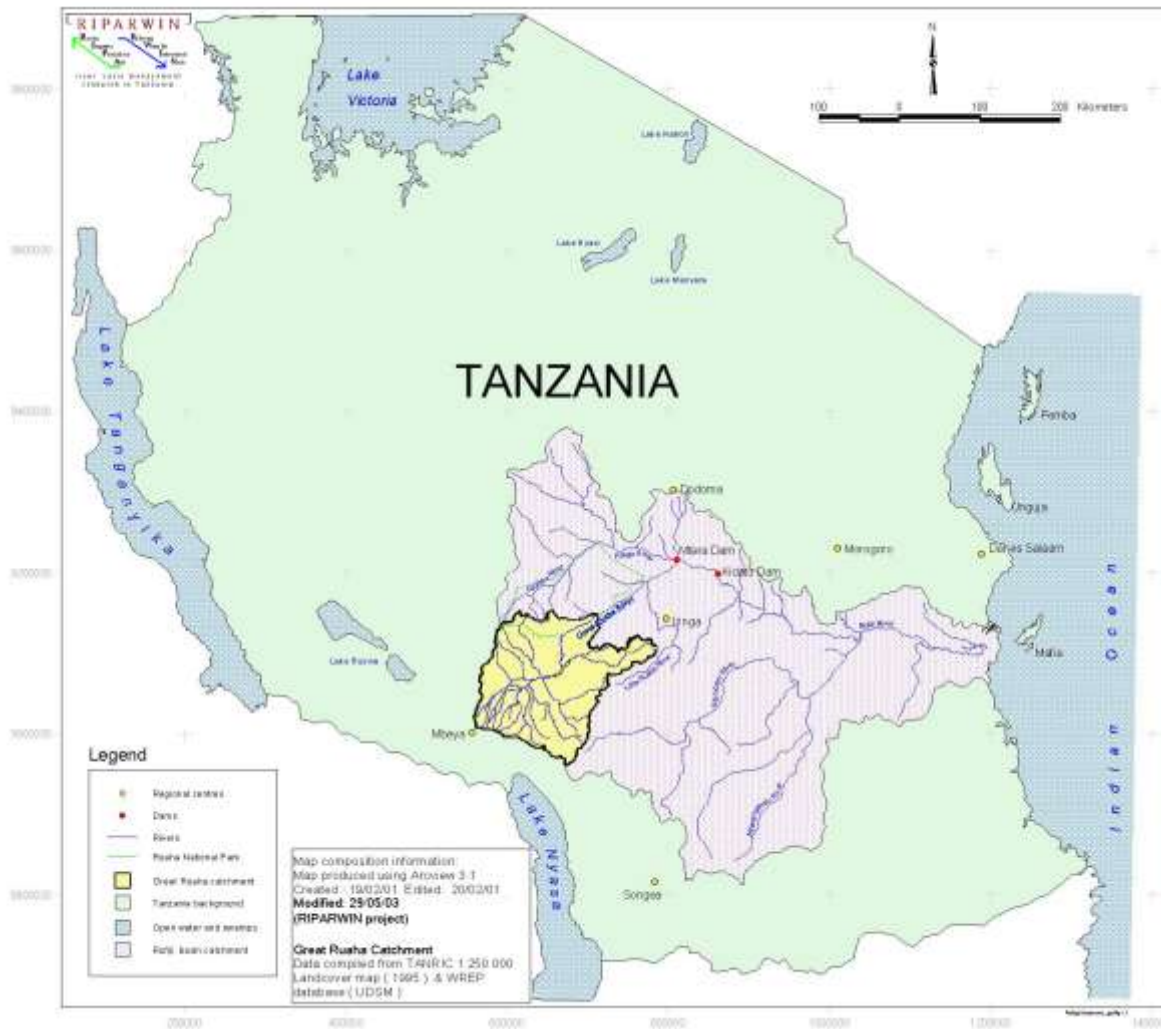


## Rainwater harvesting for agricultural productivity

Catchment  
Rainwater  
Harvesting  
Systems:  
Micro-dams  
Northern  
Ethiopia



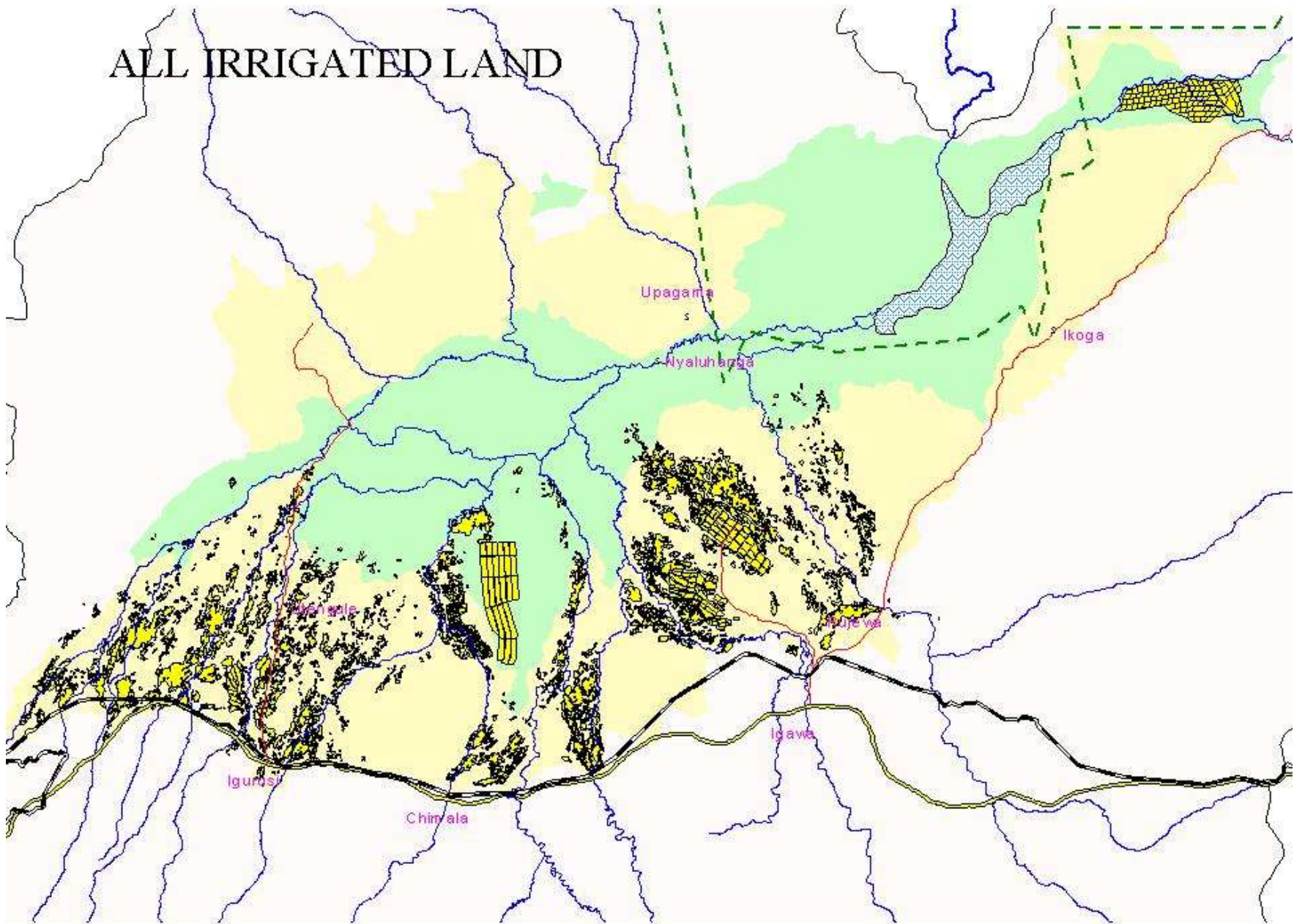
# Managing variable water supplies in irrigated catchments



- ★ Smallholder irrigation on savannah plains
- ★ Case study in southern Tanzania, Usangu Basin
- ★ Managing unpredictable highly dynamic water supplies
- ★ Areal expansion and contraction
- ★ Downstream users
- ★ Cap demand during wet and dry seasons



# ALL IRRIGATED LAND





## Difficulties in regulating upstream demand





## Watershed of the Usangu escarpment

A single river might vary from 50 to 5,000 l/sec



Runoff shared by many sectors

## Traditional irrigation intake





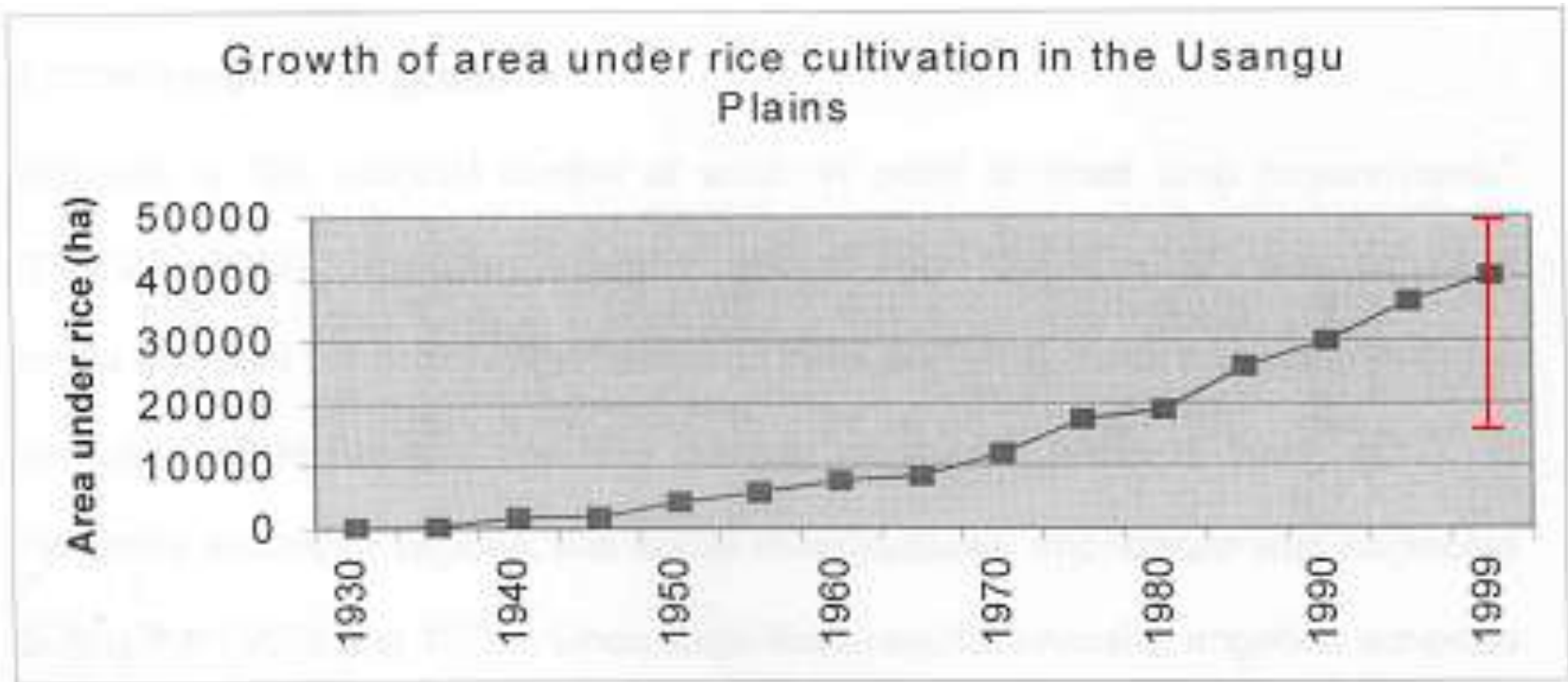
## Improved, modernised irrigation intake



# Irrigation systems, dynamically responding to supply





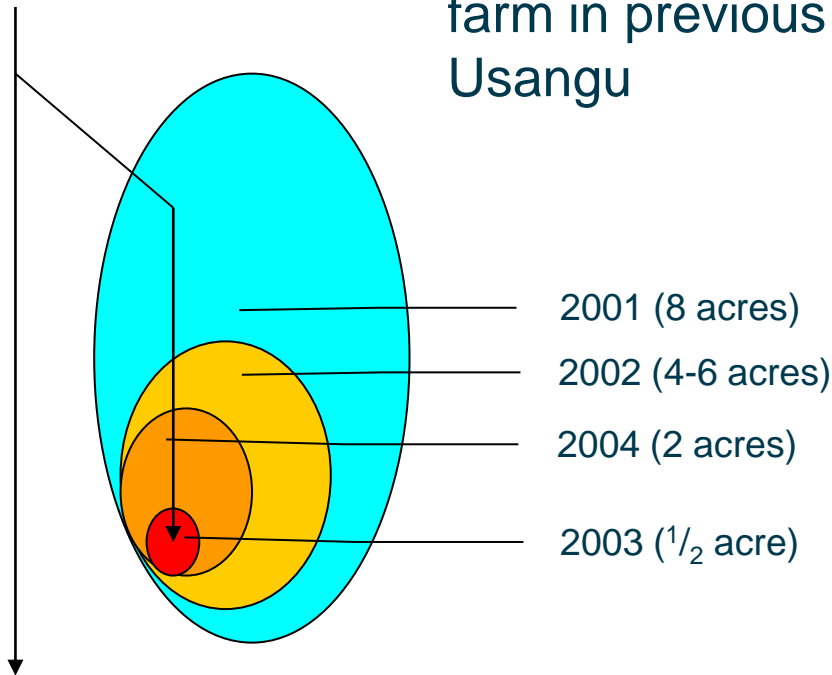


The fluctuation in irrigated rice area from year to year (the red line) is nearly as great as the average expansion in area over the last 30 years (the black line).

# Change in one farmer's area as a result of rainfall

river  
Sindemba,  
Madundasi

Change in area for a case study  
farm in previous four years, lower  
Usangu



# Specific water use (rice nursery irrigation) Rehabilitating/improving existing schemes



Water management for a rice nursery at the top-end of the Kapunga system (mechanised farm)

Water management for a rice nursery at the tail-end of the Kapunga system (smallholder farm)





# Sleeping Giant report - *Priorities for public investment. Science and technology*



## ★ Public Sector Reform and Governance (p 191)

...the state must play a **facilitating role in the development of a dynamic and equitable commercial agriculture. A major challenge is to develop governance structures and capacities for the state to assume these roles.** Ministries of agriculture that grew up with state-led input supply and marketing schemes require sharply upgraded capacities and skills in areas such as marketing and business development services, as well as the ability to forge a variety of public-private-civil-society partnerships that characterize new roles of the state. Moreover, these skills must extend well beyond the ministries of agriculture to local governments with responsibility for newly decentralized agricultural services, and to a range of other ministries such as science and technology, land, environment, and commerce and trade that have important roles in commercial agriculture.

# Natural resources management: framing collective multi-scalar understandings



Supporting irrigating farmers: adroit at *problem-framing* water management, and then drawing up new water guidelines

... versus supply-led thinking

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*“Farmers must be trained on soil and water technologies to enhance crop production and food security”*

ASARECA, 2006 Maputo Workshop statement.  
[www.asareca.org/swmnet](http://www.asareca.org/swmnet)

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## Summary – nature of water risks

- ✦ Irrigation – considerable water during growing season
- ✦ Variable supply/demand: field, farm, catchment impacts
- ✦ Timing problems/simultaneous demands for planting or if rains cease – cannot meet without tech' water control
- ✦ SSA insufficient groundwater (savannah plains not floodplains with deposited sediments)
- ✦ Downstream demands for food security/ domestic/ urban & environment/tourism
- ✦ Water rights and abstraction caps
- ✦ Water user association and groups
- ✦ Governing the collective & coalesced areas – where are water technical & institutional *deliberative services*?

## Summary cont...

- ✦ Specific locations & trajectories (Zambia/Nigeria etc etc)
  1. Private commercial arrangements and purchased uptake of technology – e.g. pedal/diesel pump
  2. Market/livelihood environment: build/operate *own* SIS
  3. Donor smallholder irrigation systems (SIS) & storage
  4. Existing scheme rehabilitation via donors
  5. Formal projects on larger rivers: intake headworks only?
  
- ✦ Affordability q's? \$10K/ha via donors. Seek \$2-3K/ha.
- ✦ Sustainability – during wet to dry seasons
- ✦ Urban / village water economic dev'

