Watering Africa’s Sleeping Giant?
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Dr Bruce Lankford
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)
“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
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
Smallholder–owned systems

0.2 ha per family group

Valley bottom/wetland irrig.
Pongola floodplain, SA

Bucket and small pumps

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.
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
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

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

Terraces in Ethiopia
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

Constructed dam in N. Ethiopia, ephemeral river, has added little extra security

Av W = 80 m
L = 120 m
D = 15 m
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
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

- 2001 (8 acres)
- 2002 (4-6 acres)
- 2004 (2 acres)
- 2003 (1/2 acre)
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)
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
“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
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?
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 donoros
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’