Drylands Learning and Capacity Building Initiative for Improved Policy and Practice in the Horn of Africa

DISCUSSION BRIEF: Irrigating Kenya's drylands – food for thought[1]

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Introduction

In Kenya agricultural production is considered constrained by dependence on 'unstable' rain-fed agriculture, and strengthening the irrigation sector is now key in national policy. Kenya has 10 million hectares of arable land, with a maximum of 1.3 million hectares reported irrigable. Irrigated areas totalled 165,833 hectares in 2011, and Kenya's Vision 2030 goal is 1.2 million hectares irrigated by the year 2030 - an increase of over 600%. Roughly 40% of the development will be 'large-scale' central government schemes (>500 ha), 32% will be 'small-scale' by county governments, and the balance will be 'enhancement' by smart incentives to private / commercial sectors. The irrigation sector is by far Kenya's largest water user, and it has been projected to account for 81% of the nation's water demand by the year 2030. Kenya's surface water resources will fail to meet this demand however, with the projected water deficit in 2030 likely to be 74% of total water demand.[2]

Illegal riverbank cultivation –Athi River

Why caution is needed in the ASALs

To satisfy water demand, the Kenyan government is proposing large-scale water storage provision to exploit average annual flow availability, as well as other irrigation infrastructure. Of the 'promising irrigation projects to realise Kenya Vision 2030,' 84% were located in the ASALs.[3] The schemes will be dealing with high solar radiation and

[1] This brief was originally prepared by REGLAP for a media breakfast in December 2013 in Nairobi. See http://www.disasterriskreduction.net/fileadmin/user_upload/drought/docs/Report_Kenya%20media%20breakfast%20on%20irrigation%20in%20the%20drylands_Dec%202013.pdf. It was updated and reprinted by its successor organisation DLCI in December 2014.

[2] Nippon Koei / JICA Study Team: *The Project on the Development of the National Water Master Plan 2030* Interim Report for the Ministry of Water and Irrigation, Kenya, dated April 2012. The assessment is based on a dry hydrological year of recurrence interval 1 in 10 years.

[3] 66 % is in arid lands, 17.4 % is in semi-arid lands. The total area tabulated is 402,900 ha, of which 289,700 ha is within the Tana Basin (Nippon Koei / JICA Study Team, 2012, ibid, p.6-21).

temperatures, and dry winds that desiccate soils and crops. The water needs for crop irrigation in ASAL areas are frequently 4 times the requirement of the cooler highlands. Renewable water sources in the ASAL areas are also scarce, and lakes are often saline. Rivers are generally seasonal, already subject to destructive natural spates, with spates exacerbated by the increasingly torrential rainfall associated with climate change. If well managed, surface water runoff from storms can be usefully regulated through storage created by a dam, and groundwater can be pumped to the surface.

Irrigation planners recognise the specifics of arid lands soils. Kenya's underlying geology comprises some of the oldest rocks in the world. The soils have an inherently low fertility index, lacking in clay content, and thus are highly vulnerable to erosion.[4] Arid land soils tend to crust with salts as a consequence of solar heating and evaporation cycles. Without sufficient flushing rainfall, or irrigation water plus effective associated drainage, salts accumulate and soil fertility further diminishes. With underinvestment and poor management, salinity and desertification can increase dramatically, damaging agricultural production.[5]

The recent discovery of underground lakes in Turkana raised hopes for an alternative water supply, but the announcement also includes warnings about sustainability.[6] These aquifers lie beneath arid lands with annual recharge capacity reported to be a mere 1.38% of the storage volumes, possibly less. Although these aquifers can be mined, they will not last long. Engineering costs to exploit the water will also be considerable, and beyond the means of local people.

The technical challenges

To achieve the Kenya Vision 2030 irrigation development goals, substantial water engineering works are envisaged to capture and manage the surface water runoff process, and convey stored water to the selected demand points. This is challenging. The feasibility of storage reservoirs is dependant on sites having suitable topography and foundation conditions. The catchments will require careful management to avoid loss of storage capacity through excessive sedimentation. Schemes will affect the ecology through nutrient re-distribution, and downstream needs will have to be preserved. Irrigation technologies that squander water cannot be contemplated for the ASALs. 'Poor' irrigation systems are those whose overall efficiency is as low as 20%, whereas 'good' systems have overall efficiency up to 60%.[7] These efficiency differences translate into huge water 'losses' that can be avoided with the introduction of new, efficient, irrigation technologies.

Learning from experience

Large-scale irrigation projects such as the Bura and Hola schemes on the Tana River provide useful examples of the difficulties that have marred large-scale irrigation development projects over many years in the drylands. The Bura and Hola schemes were challenged by marginal soils, the difficulties of ensuring reliable water supply, river channel mobility within its flood plain, and pumping problems. The water transmission distances for Bura resulted in large canal water losses. The canals also became choked with the invasive alien plant *Prosopis juliflora*.

[4] FAO Corporate Document Repository: *Land and environmental degradation and desertification in Africa…The magnitude of the problem,* docrep X5318E.
[5] FAO (1976). *Prognosis of salinity and alkalinity*. Soils Bulletin No. 31, and companion volume.
[6] RTI / UNESCO, 2013, Radar Technologies International (2013). *Advanced Survey of Groundwater Resources of Northern and Central Turkana,* Kenya, Final Technical Report, 2013.
[7] FAO Irrigation and Drainage Paper No. 56, dated 2000.

In addition, due to the absence of farming knowledge within the local pastoral community, farmers were brought into Bura from other communities, a social scenario often repeated elsewhere in Kenya in which smallholder farms have been developed near an abundant water resource, in effect an oasis within a dryland pastoral zone. Examples include the Nguruman irrigation scheme beyond Magadi, farming activities near Loitokitok on Kilimanjaro, and along the Isiolo River. In the remote areas, insufficient road and communication infrastructure has hampered access to agricultural inputs and affordable marketing outlets, compounding the challenges facing the incoming smallholder farmers.

The opportunity costs

Large-scale irrigation scheme developments will naturally favour permanent rivers and their more fertile adjoining alluvial flood plains. These areas often already provide critical dry season grazing for livestock producers, and are often already usefully integrated and complemented by small-scale agro-pastoralist irrigation. Many examples exist of the conflicts that arise from large-scale irrigated crop incursions into drylands. Pastoral communities in Ethiopia's Awash Basin were displaced from prime pastures by sugar irrigation projects.[8] Similar displacement by commercial farmers has been resisted in Kenya's Lower Tana.[9] The Lower Omo's Kuraz sugar plantation scheme near Kenya's northern international border involved major land areas excised from agro-pastoral communities and national parks, and has resulted in international accusations of human rights abuses.[10] Studies also suggest that commercial crop products like sugar are in fact less profitable than pastoralism.[11] Commercial schemes, entailing huge water abstraction, sometimes fail to consider the potentially catastrophic environmental and social consequences downstream, and even across international borders. Kuraz alone will require water that is numerically equal to 25% of Kenya's entire renewable surface water resource.[12] The abstracted water would otherwise flow into Kenya's largest lake, whose water level could consequently fall over 20 metres, with potential devastation of fisheries.[13] Irrigated crop production in one country is thus achieved at the expense of the loss of ecosystems services in a neighbouring country, without appropriate studies availed and without trans-boundary consultation.

Alternative scenarios

There is certainly potential to improve small-scale crop agriculture in ASAL areas, especially in areas where agro-pastoralists are already engaged in crop production to diversify their livelihoods and as a complement to livestock production. Developing drought and salt tolerant crops is an on-going task, together with improved techniques for soil and water conservation that are already in use at the small-scale level: for example zai pits, drip irrigation, water harvesting. These techniques require extension services alongside support for on-going livestock production. Riparian zone protection enforcement is also essential as otherwise flood and erosion risks are exacerbated.

Large-scale irrigation developments are potentially more intrusive projects, offering greater challenges in terms of water usage, impact on other livelihoods, and impacts on downstream water users. As these schemes are driven from central government, and as the traditional land use of much larger areas is affected, the early engagement of local communities through competent transparent studies is crucial.

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[8] Helmut Kloos and Worku Legesse (eds.) *Water resources management in Ethiopia: implications for the Nile Basin,* Cambria Press, New York, 2010.

[9] Nature Kenya: "Connecting Nature and People": http://www.naturekenya.org/content/tana-delta http://naturekenya.org/sites/default/files/Tana%20brief%202-3-2010.pdf

[10] Human Rights Watch, 2012: *"What will Happen if Hunger Comes?" Abuses against Indigenous Peoples of Ethiopia's Lower Omo Valley,* ISBN: 1-56432-902-X. Up to 450,000 hectares total agricultural development is contemplated – see also Avery, S.T., 2012, ibid.

[11] Michael Mortimer. *The place of crop agriculture for resilience building in the drylands of the Horn of Africa: an opportunity or a threat*, Report to REGLAP, June 2013. http://www.disasterriskreduction.net/east-central-africa/reglap/documents/detail/en/c/2864/

[12] Kenya's renewable surface water resource in the year 2010 has been estimated to be 20,637 MCM/yr (Nippon Koei / JICA Study Team, 2012). Kuraz sugar project has been estimated to require 4,862 MCM/yr of water (Avery, S.T., 2012, ibid.).

[13] Avery, S.T., 2012, ibid.

The Kenya Master Plan 2030 Interim Report stated that: "…the vulnerability of water resources is high and is going to be more critical in the future if no urgent action is to be taken…" The Report further states that: "…it is necessary to reduce the irrigation water demand…by examining the appropriate size of the irrigation area and adoption of water saving irrigation techniques…"[14]

Conclusion

Water scarcity is clearly the emerging challenge facing planners in Kenya. At the same time, there are exciting development plans to contemplate in the light of modern knowledge of dryland agriculture and water conservation. Expectations are running high, but equally important must be awareness of concerns about the manner in which large-scale irrigation development is currently being implemented elsewhere in the region. For success in Kenya, full and proper consultation will be essential throughout the process, consultations that take full account of past lessons.

Postscript

As this article was going to press, the National Irrigation Board (NIB) made a presentation to a REGLAP workshop in Nairobi advising that the potential irrigated area to be developed by the year 2030 has been downsized from 1.2 million to 765,500 hectares. This is a substantial reduction, and NIB stated that this was "largely due to degradation of the water towers".[15] The revised proportion within the ASALs is 468,362 hectares (61 % of the total), and roughly half will be in the Tana catchment area. However, NIB noted that the above figures did not include the potential new irrigated area arising from the Turkana aquifer water discovery within the Rift Valley catchment area, and hence the ASAL irrigated areas may be subject to upward revision from the above revised figure. The revised potential irrigated areas are still significant, being more than 3-times Kenya's total irrigated area in 2010.

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[14] Nippon Koei / JICA Study Team, 2012, ibid.
[15] National Irrigation Board presentation to REGLAP workshop, "Kenya's Development Plan for Irrigation Development in the Arid Land and Semi-arid Lands", 3rd December 2013