Regional Learning & Advocacy Programme for Vulnerable Dryland Communities

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SUMMARY BRIEF: The place of crop agriculture in resilience building in the drylands of the Horn of Africa: an opportunity or a threat?[1]
May 2013

Introduction

The droughts of the past decade in the Horn of Africa (HoA) have helped focus policy directions, at both national and international levels, with increasing attention being paid to resilience building and DRR. A coherent regional policy on pastoralism[2] now recognises its value rather than seeking to replace it. But rangeland fragmentation and other constraints mean that pastoralism cannot provide sufficient food security for the increasing human populations in the drylands, and alternative livelihoods are needed. Crop agriculture using irrigation is one option being proposed.

In some circumstances crop agriculture using irrigation offers the potential of increased productivity per hectare, with pastoralists in a position to take up agro-pastoralism potentially being able to reap the advantages of diversification. However, such well-intentioned development strategies need to avoid disrupting existing resilience strategies, and in particular crucial water sources found in dry season grazing areas. A number of other issues also need to be addressed: small-scale irrigation is frequently reliant on perennial rivers, and yet data on river hydrology in the HoA is largely inadequate, as is the quantitative information on groundwater and the seasonal behaviour of water tables. The potential of small-scale irrigation is also constrained by agro-ecological limitations; it requires significant inputs in terms of technologies, services and markets; and its uptake will depend on adequate investment and adaptation by its users. A review of the history of irrigation in the drylands can offer many important lessons on erosion, salinization and lack of economic returns to maintain expensive irrigation infrastructure.

Across the HoA different models for investment and cost recovery in irrigation are being tried: Ethiopia has prioritised large-scale schemes, whereas Kenya has favoured decentralized solutions - with public-private partnerships and other innovative financial approaches. Before conclusions can be drawn however there is an urgent need for more economic data on irrigation schemes, and for studies of their comparative advantages, cost effectiveness and how best to mitigate their potential negative social and environmental consequences. If irrigated crop agriculture is to be of benefit to the current users of the drylands it will need to be integrated with existing livestock and other livelihood strategies, and be initiated through participatory planning processes.

This brief is an edited extract from the study on '*The place of crop agriculture in resilience building in the drylands of the Horn of Africa: an opportunity or a threat'*, commissioned to help inform REGLAP and Oxfam's advocacy positions in relation to crop agriculture and the investment priorities for country plans towards ending drought emergencies. The report is also intended to help inform the short and long-term programming of governments and NGOs in promoting small-scale irrigation and crop agriculture in the drylands.

[1] This brief is based on a study by the same name for REGLAP by Mike Mortimore available on the REGLAP website at http://www.disasterriskreduction.net/fileadmin/user_upload/drought/docs/FINAL%20REPORT_The%20place%20of%20crop%20agriculture%20in%20the%20drylands%20of%20the%20HoA.pdf

[2] See the AU pastoral policy framework http://rea.au.int/en/sites/default/files/Policy%20Framework%20for%20Pastoralism.pdf

Context - the uncertainty facing pastoralism

Mobile pastoralism responds to the environmental uncertainty of the arid and semi-arid lands (ASALs) using short, medium and long term strategies; but interactions between pastoralists and their dryland environment are under increasing threat, undermining the productivity of the production system. The Report classifies the existing context in terms of six 'themes of uncertainty': rainfall variability, variability of water resources, demographic change, land use change, markets, and investment.

Rainfall variability is the root cause of the uncertainty in drylands, including extremes of drought or flooding, although there is controversy surrounding the question of whether this variability has recently increased.[3] Limited attention has been given to the local knowledge and adaptive strategies with which pastoralists manage this variation opportunistically. It has also now become customary in expert discussions to regard local adaptive capacity as valid in the past, but inadequate now to respond to the speed and magnitude of current change (climatic, demographic, or economic). The **variability of water sources**, in particular the hydrology of surface and underground water resources, is a second theme in pastoralist uncertainty: the dryland habitats of mobile pastoralism rarely enjoy reliable surface water except where perennial rivers are fed from more humid uplands.

The future of pastoral livelihood systems as a whole faces considerable uncertainty in the face of **demographic change**. In Turkana, for example, a growth in the pastoral population since 1997 combined with the impact of repeated droughts has led to an overall fall in the numbers of livestock per capita (from 4-5 TLUs[4]/capita to 1-2 TLUs/capita). In addition not all households are affected equally: 10% of households now own 60% of the cattle, while 51% have none.[5] Uncertainty is also seen within the **changing land use** systems in the drylands: degradation is believed to be increasingly widespread—especially in so-called 'hot spots' such as Turkana and Karamoja; whilst 'fragmentation', or the appropriation of land by external corporations and large-scale private farmers and stock breeders, is progressively reducing the amount of rangeland available and obstructing access to essential water sources.[6]

In an increasingly monetized world, smallholders (whether farmers, pastoralists or agro-pastoralists) now participate more and more in **markets**, with their transactions exposing them to global risk and further uncertainty. This trend is unstoppable and is proceeding independently of environmental change. New capital inflow/**investment in** pastoral regions is setting up yet further sources of uncertainty and change, often framed as a clash between customary rights to pasture and water on the one hand and outsiders armed with title deeds for land issued by central governments on the other.

The demand for small-scale crop agriculture among pastoralists in the HoA

Pastoralists are already experimenting with complimentary livestock options. At the regional scale, in the major river valleys of the Somali Region, irrigation in some river basins is already exploiting most of the potentially irrigable land, based on small holdings, diesel pumps, hand labour and sub-optimal fertilizer treatments - on a 'low input - low output' basis.[7] Pastoralists are reportedly being driven into farming by their declining livestock holdings, and by

[3] The International Livestock Research Institute (ILRI) predicts a significant shortening of the growing season between 2000 and 2020, especially along the arid margins in sub-Saharan Africa [Thornton P.K., Kruska R.L., Henninger N., Kristjanson P.M., Reid R.S., Atieno F., Odero A.N. & Ndegwa T. (2002), Mapping poverty and livestock in the developing world. Nairobi: International Livestock Research Institute]. An alternative study shows significant negative trends in the northern Sahel and the short rains in western Kenya, but positive trends in western Africa and the long rains of western Kenya [Vrieling, A., de Leeuw, J., Said, M., & Ericksen, P. (2012), Length of growing period over Africa: variability and trends from 30 years of NDVI time series. Remote Sensing 2012, 4, 1-x]

[4] TLU: Tropical Livestock Unit.

[5] De Leeuw, J., *pers.com.*

[6] Flintan, F. (2011) Summary Brief: The causes, processes and impacts of land fragmentation in the rangelands of Ethiopia, Kenya and Uganda. REGLAP; Summary Brief: Why halting the fragmentation of the rangelands will improve the drought resiliency of Ethiopia's pastoralists? REGLAP

[7] Devereux S., *Ibid.*; AWG (nd), Irrigated and rain-fed farming in Somali Regional State, Ethiopia: lessons learnt. Agricultural Working Group

shortages of grazing land. They tend to accord low status to farming ("he who bends his back will not succeed"). The labour requirements of year-round irrigated farming are not compatible with the needs of mobile pastoralism, except for large families. But many Somalis, nevertheless, have recently negotiated access to irrigable land and water adjacent to the pre-existing schemes on the Shebelle River, and the privatization of land for irrigation has led to disputes.[8] Its rising value also attracts speculators and entrepreneurs from the towns. The cultivated area in the State increased threefold between 1973 and 2010. Security of land tenure is an urgent issue for (ex-) pastoralists, many of whom do not expect to return to mobile pastoralism.

In Kenya, a strong demand for horticultural products (including exports) is driving a 'new frontier' in small-scale irrigation, based on the use of low-cost technologies, wholly or partly made in the country. The technologies include rainwater harvesting, bucket irrigation, gravity fed sprinkler and drip, treadle and pedal pumps, rope and washer, motorised pumps, wind power and small earth dams.[9] Small-scale irrigation uses an estimated 50,000 ha; the total irrigated area is 80,000 ha of a potential area of more than 300,000 ha. The Ministry of Agriculture has a target of 40,000 additional ha per year.[10] Significantly, small-scale irrigators in Kenya raise their own capital from private savings, attracted by good profits. Compared with farm incomes from rainfed land, which average less than US$750/ ha, irrigated land can produce 2-3 crops a year worth US$1,400 (snow peas, French beans), US$450 (kale) or US$600 (onions).

Some agencies are working with agro-pastoralist communities in semi-arid areas of the country to promote soil and water conservation technologies as an alternative to irrigation but the gains (or losses) made from these experiments have not been quantified to justify or dismiss the innovations at this point in time. Anecdotal stories from the farmers suggest that even in cases where a household is participating in the experiments, livestock keeping (especially of small stocks) remains a major part of the livelihoods systems of the household providing up to half of the household income and food.

Small-scale irrigation in pastoral areas of Kenya today is a different story to the past, both in the specifics of particular cases and in the nature of the challenge. Pastoralists displaced by the Shifta rebellion in the 1960s took up irrigation in the Tana flood plain with government support, but when this was removed, the farms languished until renewed support was forthcoming. Many used farm incomes for re-stocking (as in the Shebelle Valley in Ethiopia) and went back to mobile pastoralism. The crucial difference was and still is marketing access and costs.[11] According to informants, sustainable irrigated cropping in the Garissa area depends on the removal of compulsory payments to the scheme revolving fund, better transport to market, resolving the competition for labour between farming and herding, giving equal opportunities to women (whose participation in farming is crucial), ending the inefficient under-use of field holdings, and improving efficiency and equity in water management.

The economics of crop agriculture versus pastoralism

Data on the relative costs and profitability of small-scale irrigation, compared with mobile pastoralism, are rare or non-existent, however an important study based on the Awash valley of Ethiopia using a comparison of returns to pastoralism with those to large-scale irrigated cotton and sugar plantations.[12] It uses two scenarios (low and high) for stocking rates, and estimates of total primary production on riverine rangeland (together with research-based assumptions of species composition, age and sex structure of the herds), to compute numbers of tropical livestock

[8] Gomes N. (2006), Access to water, pastoral resource management and pastoralists' livelihoods. Rome: Livelihood Support Programme, FAO
[9] Purcell R. (nd), Potential for small-scale irrigation in sub-Saharan Africa: the Kenyan example. FAO and The World Bank; Avery S.T. (2010), Coastal Rural Support Programme, Water Master Plan Study. Aga Khan Foundation
[10] Gichuki, F,N., *pers.com.*
[11] Farah K.O., Nyariki D.M., Noor A.A., Ngugi R.K. & Musinba N.K. (2003), The socio-economic and ecological impacts of small-scale irrigation schemes on pastoralists and drylands in Northern Kenya. J.Soc.Sci 7/4: 267-274
[12] Behnke R. & Kerven C. (2013, in press), Counting the costs: replacing pastoralism with irrigated agriculture in the Awash Valley, North-eastern Ethiopia. Climate Change Working Paper 4, London: IIED

units (TLU), of animals, and of breeding females per ha, in order to assign values to milk produced for human consumption and other livestock products. Factoring in the husbandry costs (which include weapons for self- and herd protection), estimates are made of net returns to one ha of riverine land under seasonal pastoral use. An economic analysis of data on cotton and sugar production then also estimated net returns per ha. The analysis took into account that sugar is partially refined on site before entering the market. This adds considerably to its value per ha.

The conclusion of the analysis was that livestock production is more profitable per ha than estate cotton production, and this finding is supported by evidence of declining interest in large-scale production of cotton in Ethiopia. Using the world price for sugar cane (as no raw cane sugar is sold locally), it is shown that cane sugar too is less profitable than pastoralism. Both findings were predictable. The estate factory processes sugar cane and this value adding makes the enterprise profitable. However even processed cane sugar struggles to exceed in value that of pastoralism - in only two years since 2002 has it exceeded it.

There is no reason to think that small-scale irrigators outside such a large-scale irrigated plantation would be more profitable (the fixed capital costs of infrastructure etc. were not factored into the estimation). Unless compatible estimates of smallholders' actual returns show otherwise, this study appears to imply that the economic rationale for switching rangeland (even rich riverine rangeland) to irrigated sugar production must lie elsewhere than in increases in economic returns per ha.

The observed tendency for small-scale, ex-pastoral irrigators in Wabe Shebelle (Ethiopia) and Garissa (Kenya) to use the profits of farming to finance restocking suggests that under present conditions, irrigation (of any marketable crop) may still be seen as a second-best option to pastoralism - a means to an end rather than an end in itself. The unanswered question is whether the 'present conditions' can be ameliorated to an extent that will make small-scale irrigation an attractive option for larger numbers of pastoralists. The values of snow beans, French beans, kale and onions in Kenyan markets (quoted above) and the 'boom' in small-scale irrigation suggest that such an optimization is within the bounds of possibility. However small-scale irrigators may not accurately compute their business strategies (for example, by under-valuing family labour).

Outstanding needs and issues in irrigated crop agriculture

For small-scale irrigation to become a more viable and attractive proposition a number of issues need to be addressed:

Knowledge and data - Water resource development, and small-scale irrigation in particular, is insufficiently supported by knowledge in the Horn of Africa. At the conceptual level, there is a need for better understanding of integrated development pathways based on sustainable ecosystem management across the sectors and borders. Narrowly conceived interventions need to be contextualized. An important part of this challenge is an effective integration of development strategies with emergency response capacities. At the practical level, is the need for more and better data sets on all natural resource management themes - from hydrological monitoring and modeling, through rangeland management regimes, to the choice of irrigation technology, agronomy and performance of crops. While these issues are often solved by trial and error - by experimenting farmers - good practice in intervention design and implementation should depend on more scientific data banking in order to improve efficiency and increase the likelihood of success.[13] These data need to be both generic and site-specific.

[13] For example, hydraulic infrastructure is critically important for pastoralism as well as for irrigation. The extraction of underground water (away from rivers) for irrigation may, however, be uneconomic or unsustainable in the long term depending on the characteristics of the aquifers.

Some studies have been carried out in projects or along rivers with valuable lessons being learnt e.g. in the Shebelle River valley.[14] There is a need for consolidation of this knowledge and development of replicable models.

Economic analysis - There is an urgent need for economic analysis on small-scale irrigation, including alternative operational farm management models, comparative returns from small-scale irrigation and livestock,[15] questions of sustainability, and both input and output markets. The balance of supply and demand side factors is especially critical in a region where environmental uncertainty or risk combines with market constraints. The economics are also site-specific and fluid, calling for monitoring of adaptive practice from year to year. There are studies available in descriptive form of particular projects, but their value would be enhanced by data on measurable parameters.

Access rights - Land resource governance, including both land tenure institutions and access rights to natural resources, and also land use zoning, are an outstanding issue. In particular is the need to reconcile equitably the claims of both pastoralists and farmers, and to provide better advice to governments committed to policies of leasehold allocation to corporations. The conflicts of interest have been identified, at least in a general sense, but less work seems to have been done on finding practicable solutions. The highly dynamic political economy of the arid and semi-arid areas calls for detached policy analysis.

Finance - Cost recovery problems have shadowed small-scale irrigation schemes supported by external donors or governments, caused by top-down management. New models of capitalization are required. Experiments in new financial and management packages have now begun to yield lessons in Kenya. A public-private partnership (PPP) leases common or community trust land, and shares capital costs between private investors and local farmers. A company manages the scheme. As profits accumulate, the leased plots are taken over by small-scale farmers, so the land stays with the community.[16] An alternative approach is one in which private investors with local connections are prepared to abandon profit maximization in favour of the social rewards of philanthropy. 'Impact investments' which aim at social as well as economic benefits for reasons other than profit maximization are gaining ground as a new class of financial assets.[17]

Balancing water demand - There is no shortage of proven technologies for small-scale irrigation and water management.[18] However, extensive irrigation infrastructure cannot or should not be constructed in isolation from other uses. Besides the needs of animals, dam construction for storage, micro-catchments and rainwater harvesting on fields, supplies of potable water for homes, schools, etc. have to be balanced with available precipitation, and perennial or underground flow at the level of the local community, where uncertainty may lead to disputes.[19] Every country needs a Water Act, effective in regulating access to water and in particular, reconciling the demands of industrial users (e.g., flower growers) and large-scale irrigators with those of pastoralists, who also need land use zonation to protect their reserve pastures.[20]

Good practice in promoting small-scale irrigation

[14] Fernstein/Tufts University (2010), Impact assessment of small-scale pump irrigation in the Somali Region of Ethiopia. PLI Policy Project, USAID/Feinstein/Tufts; Agricultural Working Group (n.d.), Irrigated and rain-fed farming in Somali Regional State, Ethiopia: lessons learnt

[15] REGLAP (2013), Outcomes of the crop agriculture in the drylands workshop, ILRI, Nairobi, 6th February 2013

[16] Grimm, J. & Richter, M. (n.d.), Financing small-scale irrigation in sub-Saharan Africa. Part 2: Country Case Study Kenya. GTZ/ The World Bank

[17] J.P.Morgan (2010), Impact investments: an emerging asset class.

[18] Mati, B.M. (2005), Overview of water and soil nutrient management under smallholder rain-fed agriculture in East Africa. Working Paper 105, IWMI. (2007), 100 ways to manage water for smallholder agriculture in Eastern and Southern Africa. A compendium of technologies and practices. SWMnet Working Paper 13, IMAWESA.

[19] Gichuki, F.N. (2000), Makueni District Profile: water management, 1989-1998. Working Paper 3, Policy requirements for farmer investment in semi-arid Africa, Drylands Research, UK.

[20] Western, D., *pers.com.*

A guide to planning and managing small-scale irrigation schemes in semi-arid areas has been provided by FARM-Africa.[21] Good practice in irrigation development should include:

1. Planning that recognizes system interactions, reconciles contested claims to resources, and follows democratic principles

Land use plans that recognize non-irrigation resource values (grazing, wildlife, tourism) should reconcile competing claims, and guide both the planning of large-scale schemes and the release of titles to small-scale irrigators. This is a governance and policy issue, requiring open stakeholder negotiations and legally enforceable outcomes. Several NGOs have developed models and accumulated experience for use at the local level. The challenge is to up-scale democratic principles in land use planning.[22]

2. Fully participatory irrigation development and regulation

Effective 'ownership' through community consensus (rather than imposition from higher authority) is a precondition for securing the discipline necessary for sharing water management and other responsibilities in a community-based irrigation scheme, whatever its size.

3. Promotion of multi-sectoral livelihood strategies

Recognising system-wide linkages in household livelihood strategies is crucial: irrigated smallholdings usually form only one livelihood element in a household which may also feature livestock, rainfed farming, and off-farm incomes, whether local (e.g. charcoal making) or distant (involving migration elsewhere). There is need to undertake impact studies on the reported evidence of change in income, especially in technology-backed rainfed farming before such initiatives can be rolled out especially to communities living in drier areas.

4. Exploitation of the complementarities between production systems at the local level

Crop agriculture should recognize the complementary benefits of livestock production, such as using crop residues and rotating main crop harvesting throughout the year. These positive features of irrigated agro-pastoralism improve resilience to drought, and encourage flexibility in relation to the market economy.

5. Encourage innovation relevant to small-scale production units

Experimentation with crops and farm technologies comes naturally to farmers, and needs encouragement or even financial incentives. Technological advances need to be developed with the active participation of the users. Technologies for small-scale irrigation are known and well documented.[23]

6. Promotion of soil conservation and water use efficiency in primary production

Proximity to river systems and sloping valley sides are likely concomitants of irrigation. Over-reliance on silt fertilization on flood plains may lead to significant nutrient loss. To maintain productivity a supply of fertilizer is always essential on large-scale farms, and its absence on some small-scale irrigated land will eventually undermine economic viability. Agro-pastoralists reap an additional benefit from a constant, though often inadequate, supply of organic fertilizer. According to farmers in Mwingi (semi-arid area in Kenya), introduction of soil and water conservation technologies such as terracing of sloping lands and zai-pit and furrow technologies coupled with labour-share and financial support increased farm outputs considerably leading to increased household income and improved food security.

Conclusions

[21] Carter R. & Danert K. (2006), FARM-Africa Ethiopia: planning for small-scale irrigation intervention. Working Paper series 4, FARM-Africa
[22] Flintan,F., (2013) Plotting progress: Planning in the drylands of Kenya, Ethiopia and Uganda, REGLAP and *pers. com.*
[23] Mati, B.M. (2007), 100 ways to manage water for smallholder agriculture in Eastern and Southern Africa: A compendium of technologies and practices. SWMnet Working Paper 13, IMAWESA.

Far-reaching land use change in the drylands is the result of new unprecedented pressures on land from livestock numbers, farmers, corporations and governments. The investment landscape is changing rapidly as dryland resources are re-valued upwards, and external actors increase their involvement. Urbanisation and international trade are encouraging increased participation in markets and the diversification of household livelihoods. In these circumstances, crop agriculture using small-scale irrigation is seen as a viable alternative livelihood option for current and ex-pastoralists.

What is not yet fully apparent is the level of demand for crop agriculture from pastoralists themselves, and whether such demand is a reflection of wealth differentials. The key to success with improving pastoral sector performance is the retention of the essentials of the existing system, rather than its transformation according to a different model. Pastoralists, like dryland farmers, need space in which to adapt, according to individual or family circumstances, and to the opportunities open to them. Adaptive capacity tends to correlate with wealth, with economic differentiation now increasing, as larger herds, motor transport, electronic communications and commercial service provision favour the better off. The implementation of good practice principles can help address these issues.

Irrigation has potentially harmful side effects, as well as positive potential. The largest gap between future potential and present achievement is in irrigable land within reach of rivers and markets, and this is being reflected in the pace of public sector and small-scale initiatives here. Technologies and strategies for dealing with the harmful side effects of irrigation are now better known, improving the overall quality of irrigation development. Taking account of the diversity within the region, a number of outstanding gaps and issues remain to be addressed however before crop agriculture through irrigation can be seen as appropriate for the drylands. These include: better data on natural resource systems and their exploitation; the economics of small-scale irrigation, its management and comparative advantage; cost-effectiveness, social and environmental consequences; and resource governance—especially issues of tenure security. A framework for action may include technical, economic / financial, and policy/ institutional agendas—worked out for particular countries, sites, policy orientations and institutional architectures.

Whatever its 'pros' and 'cons', the drivers of irrigated farming (macro-economic policy at the large scale and market-driven autonomous small-scale initiatives) are already established features of the economic landscape and cannot be ignored or reversed. To ensure the approach is more balanced, drylands development actors should be seeking to integrate small-scale irrigation and livelihood diversification alongside existing systems of mobile and agro-pastoralism—with interventions taking account of the dynamics of the multi-sectoral, human-ecological systems. Continuation of pastoralism in some form is too important to be made a hostage to fortune through either unregulated 'market forces' or inadequately tested radical change. With the beginnings of a convergence of policy objectives in the HOA on the livelihood expectations of poor people (now seen as solutions rather than as problems), all interested stakeholders can now work within the same frame of reference, throughout the spectrum of development and drought risk reduction.

Humanitarian Aid
and Civil Protection

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A copy of this brief and other information on REGLAP can be found on:
www.disasterriskreduction.net/east-central-africa/reglap