ECHO Best Practices Note

No. 3

Assisting Pastoralists

These are recommended best practices that ECHO promotes for assisting pastoralists. In gathering content for this document, Director of ECHO's East Africa Impact Center, Erwin Kinsey, drew on his years of experience as an agricultural development worker in Tanzania. ECHO publications referenced in this document include ECHO Development Notes *(*EDN*),* Technical Notes *(*TN*), and ECHO East Africa Symposium (EEAS) presentations.* Technical Notes *and* EDN *issues can be found by clicking on the "Publications" tab on ECHO's networking site, ECHOcommunity.org; East Africa documents and presentations are found by following the "East Africa Center" tab on the main menu. ECHO documents are freely available to registered members of ECHOcommunity.org; click on "Register" for information on how to register, free of charge, for basic membership or membership as an agricultural development worker. Much of the material was also gleaned from networking with other groups whose references and publications are listed. Unless otherwise noted, photos are courtesy of Erwin Kinsey.*

Introduction

Pastoralism described

Pastoralism is a livelihood whereby people depend upon herding domesticated livestock. In East Africa, pastoralists depend primarily upon cattle, sheep, donkeys, goats and camels—listed in order of least resilience as one moves into drier and more arid lowland areas. Pastoralists play an important, though often underappreciated, role in safeguarding animal genetic resources and indigenous breeds. In caring for their animals, pastoralists have a unique ability to utilize vast remote, drought-prone areas by regularly moving their herds to the best grazing areas. In fact, East Africa's most celebrated large conservation areas exist today partly because of pastoralists' capacity to traverse and defend grazing areas, which helped create buffer areas of reduced encroachment by agriculturalists.

To better understand the migratory aspect of the pastoralist's life, it is helpful to be aware of the terms "nomadism" and "transhumance" used to describe the primary forms of pastoralism. Nomads do not create permanent settlements but move to or carry temporary structures with them; their migratory pattern can change from year to year. East African pastoralists are "semi-nomadic," having a permanent home base where some of the family stays while others are out with the herds. The diet of nomadic pastoralists is based largely on livestock and food gathered from the wild. During the dry season and droughts, animals are sold to buy staple food.

Transhumant pastoralists usually migrate between two or more permanent settlements, alternating between the same locations; they rely less upon animal products alone, often engaging in seasonal farming, and are more likely than nomads to be engaged in marketing their produce (O'Neil 2011). Most pastoralists are nomadic, transhumant, or some variation of the two.

Typical features of pastoralist societies, though certainly not exhaustive, include the following:

Use of semi-arid open country (where agriculture often is not sustainable) for livestock grazing, and moving herds/flocks to areas of forage depending upon rainfall; this mobile advantage is less available to agricultural societies. In recent years, pastoralism is being appreciated more fully for its efficient use of semi-arid regions to convert unusable natural resources into food, despite unpredictable climates and livestock disease epidemics.

What's Inside:

by ECHO staff

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Large herds, which are perceived as symbols of wealth and security. During years of good rainfall, herds may expand rapidly within a few years, making the pastoralist lifestyle potentially one of the quickest means of wealth accumulation. On the other hand, livestock can quickly be lost to drought, livestock raiding, diseases, displacement by government/settlers/hunting companies or other disasters. The remarkable resilience of pastoralists, in the face of such unpredictable conditions, is due in large part to the mobile nature of their livestock production system.

Use of consensus and communal strategies for grazing and watering of herds/flocks. Where and when resources become scarce, decisions can be made that lead to conflict. However, even during times of scarcity, consultation and negotiation efforts take place to preserve the welfare of the family.

A strong emotional attachment to livestock. Beyond being a primary means of asset accumulation, pastoralists also use animals for draught power, rituals, food and trade.

Meat is shared by the larger community rather than sold. This builds community solidarity, and results in reciprocal obligations.

Patriarchal societies, exacerbated through the colonial and post-colonial period (Hodgson 1999). However, gender issues among pastoralists are exceedingly complex and have both advantages and disadvantages (Hodgson 2011). In general, patrilineal descent patterns allow men to quickly make and act on important decisions, without consulting wives. Men own large animals, and trade or sell them to obtain several wives. Young men obtain prestige and demonstrate bravery through acts such as predatory raids or defending herds from wild animals; at later stages in life, they gain prestige by accumulating large herds and many wives and children.

Women are responsible for nurturing children, home construction, water and fuel collection, and food gathering and preparation. Women lack political power, and are marginalized in most aspects of life. Yet, they have significant authority over such assets as milk and small ruminants, and can subsist on their own to some extent by controlling the income they generate.

A disdain for agriculturalists, from whom needed grains and pulses are acquired, stems from broken trust between pastoralist and agricultural groups. This can lead to raids on each other's animals or lands.

Challenges described

Although pastoralism is compatible with dryland conditions, pastoralists are among the most food-insecure of the world's people. This is due to a combination of factors, including unprecedented climatic challenges and outside influences. While unpredictable rainfall patterns and drought are expected occurrences in semi-arid areas, some of the worst droughts on record in Africa have occurred in the last decade. Their impact has been far worse in pastoralist areas despite their innovative coping mechanisms (Catley et al. 2012). Weakened animals are more susceptible to disease outbreaks, which also take their toll. In many areas, calf losses often exceed 50% in normal years due to preventable diseases such as East Coast Fever. Outbreaks of less common diseases also occur, especially during rainy years; these diseases include Rift Valley Fever, Pest de Petit Ruminants, Blue Tongue, Contagious Bovine/Caprine Pleuro-pneumonia, and–until recently–Rinderpest (now eradicated worldwide).

Pastoralists have faced centuries of losses since the pre-Colonial era. In most areas of the world, they have had to adapt to dramatic historical changes that have occurred since the 19th century and that continue today. These changes include the population boom; land alienation by agriculturalists and governments; herd decimation from imported diseases such as Rinderpest; subjugation and marginalization by colonial and post-colonial regimes which have not comprehended the complexity of the pastoralist life or its use of land and resources; destitution from periodic drought; and the erosion of sharing mechanisms from within the societies.

Few national governments have been able to formalize efficiently the market for pastoralists' livestock. Failing to appreciate pastoralists' essential role as a reservoir of livestock that feeds the informal economy, or their capacity to use arid lands more effectively than other alternative users, national governments have tried continuously to force pastoralists to stop migrating and to settle down, purportedly in order to ease social disparities that include lack of access to education, health facilities and roads. Pastoralists have been pressured against their will to reduce herds to prevent over-grazing and to provide a source of taxation. Such policies limit pastoralists' options in employing a range of viable strategies, based on extensive indigenous knowledge, to match stocking densities with available grazing resources (El Hadary 2012; Scoons 1995).

Many other challenges have led to vulnerability of pastoralists to natural and man-made shocks. Though these challenges overlap in their effects, they are divided below into socio-political-cultural, environmental and physical, and economic categories:

Socio-political-cultural Challenges

- conflicts with agriculturalists and national governments over land and water resources
- increasing social and political marginalization
- little access to education, health services and political influence
- insecurity due to rustling, compounded in border areas by cross-border attacks
- difficult to create safety networks due to low population density and the fact that people are scattered
- patterns of seasonal mobility require households to split
- low number of food groups in diet (but these include products high in nutritional value)
- lower HIV/AIDS rates in cirumcised men makes them more prone to risky sexual behavior, increasing the risk of infection in women
- rapidly increasing human population

Environmental and Physical Challenges

- livestock pressure from overgrazing or uncontrolled grazing, and from overuse of watering points
- a degrading resource base, due to deforestation, soil erosion, siltation of streams and rivers, reduced water infiltration, and a gradual drop in the water table
- potentially rapid reproduction of livestock, beyond carrying capacity of range lands
- inconsistent rainfall and the need to move animals to where fodder is available
- wildlife interactions such as predation and cross-species disease (e.g., rabies, Malignant catarrhal fever)
- temperature extremes (heat in lowlands, cold in highlands) affect human, animal and plant life
- remoteness–far from modern services outreach and with a need to travel long distances to find water, agricultural produce and fuel wood

Economic Challenges

- worsening poverty and food security conditions among a large part of community, owing to challenges listed above
- declining per capita productivity rates among growing populations with finite resources
- wealth concentrated among fewer households and destitute people performing tasks as hired herders; more wealthy elites provide informal security, credit and social functions, but the result is weaker safety nets as traditional clans' capacity to carry the destitute has eroded
- long distances to markets, and general lack of formal markets or of information to enable pastoralists to get fair market prices for their assets
- conflicting interests of men (maintaining economic base) and women (addressing household needs) in regards to assets

For more information on the challenges and importance of safeguarding pastoralist livelihoods, see the World Initiative for Sustainable Pastoralism.

Principles

How can pastoralists' livelihoods and food security improve within their physical and social environment? The purpose of this section is to highlight principles which can guide decision-making when designing interventions among pastoralists.

There are no simple solutions or specific practices that work under all conditions

Climatic conditions vary with location, as well as other factors such as policy, government and markets. All of these factors should be taken into account in any interventions to assist pastoralists. Crop production is more likely to be a viable option for transhumant versus nomadic pastoralists. Any cropping system or set of farming practices needs to be suited to local conditions, account for grazing animals, and maintain the long-term productive capacity of the land (see ECHO *Best Practices Note* no.1 for information on improving degraded lands).

Changes are inevitable

Uncertain and radical changes are affecting pastoralists' land/environment, access to resources, options for mobility, cultural coping mechanisms, and opportunities for marketing their products. In some areas, changes occur that provide opportunities for vibrant, market-oriented livelihoods. In other areas, marginalization and poverty may worsen. The goal of change agents should be to increase pastoralists' ability to be resilient and to improve their livelihoods in all areas.

Livestock ranging is the only appropriate livelihood option for many pastoralists

Practiced in most arid and semi-arid areas, this livelihood option is an efficient form of land use and acceptable to most pastoralists. Their resilience in the face of dry, unpredictable conditions attests to the validity of a livestock management strategy that hinges on mobility. Development initiatives need to include the livestock services sector and introduce an appropriate array of options that hopefully will (1) benefit a diverse spectrum of the population, not neglecting any group or exacerbating wealth differences and (2) result in harmonious utilization of natural resources.

Participatory approaches encourage a sense of ownership

Pastoralists need to lead in the selection of issues to address and related technologies. The needs of both genders and of different age groups need to be considered, as their priorities tend to be different.

More investment in research and development is needed

Much has been done to develop innovation in African agriculture, but relatively little investment has been made in pastoral systems. If evidence-based technological innovations are to drive pastoralist economic and social improvements, increased investment is needed in research and development. Specialized strategies for different areas and populations will enable targeted use of diverse drylands for animal and/or agricultural production.

Practices

While no single recommendation applies in every case, below is a list of best practices that ECHO's staff and network of development workers have found to be effective. The content below focuses on livestock practices and on land use and natural resource management technologies. See the "For Further Reading" section for links to a wealth of information pertaining to each of the practices outlined below.

Improving rangelands in pastoral areas

Best practices will develop participatory land use plans and appropriate water development initiatives that do not destroy the environment in which land and water resources are found. Land and water issues in pastoralist areas have been reconciled effectively through the following.

Practice: Using participatory methods to help communities develop or optimize land use plans (Waters-Bayer and Bayer 1994). This helps ensure that pastoralists are able to establish their own bylaws to sustainably safeguard the natural and physical resources in the community for the common good. Where possible, utilize digital map-making technology to enhance the accuracy of communal grazing land use mapping and planning.

Practice: Utilize appropriate systems, such as:

- Farmer Managed Natural Regeneration (FMNR), a method of reforestation in which farmers allow and manage regrowth of stumps of native trees in their fields. This method yields faster results and is more successful than traditional tree planting.
- Farmer Managed Agroforestry System (FMAFS) integrates trees and crops through intentional planting of native as well as exotic trees; the combination reduces pressure on natural woodlots and addresses the diverse needs of the community.
- Holistic Management (HM) of resources: Allan Savory has initiated HM hubs in East and Southern Africa. Controlled grazing (to prevent both overgrazing and under-grazing by free-roaming livestock) can restore significant amounts of biomass in rangelands. Two methods to control animal grazing are cut/carry systems and rotational grazing of blocks of land. As with any system that is new to an area, test it in a controlled manner in small plots of land before expanding.

Tree stumps pruned as per the FMNR method. *Photo by Tony Rinaudo.*

Improving livestock management in pastoral areas

Practice: Facilitate provision of vaccinations during critical periods, such as high-rainfall years, when disease outbreaks are likely to occur. Involve local community animal health workers in addressing common, widespread pests and diseases adversely affecting livestock health. Diseases to be aware of include CBPP (Contagious Bovine Pleuro-Pneumonia), Rift Valley Fever, Pest de Petits Ruminants, East Coast Fever, and Newcastle Disease.

Practice: Assist in the identification and control of parasites. Consider facilitating a Pastoralist Field School (FAO and VSF Belgium 2009) to train pastoralists in addressing livestock parasite issues. Recognize the high level of dependence upon traditional, ethno-veterinary medicine (e.g., local remedies for controlling parasites, or preferred grazing sequences) and the fact that pastoralists' goats and sheep have developed a certain level of immunity to parasite burdens through natural selection.

Practice: Provide mechanisms to buffer losses of livestock prior to or in rapid response to catastrophic events. Consider the following strategies:

- Create an option to convert to cash by buying up animals. Such a provision is especially relevant to owners of large herds. For owners of fewer animals, food aid can provide an alternative to reducing livestock for give-away prices.
- Restock livestock to help with recovery from catastrophic droughts or disease epidemics that decimate herds. Be aware of factors influencing the success or failure of restocking efforts (Heffernan et al. 2001). Efforts are typically more successful with pastoralists who have just recently lost their animals versus those who have started to become accustomed to a more sedentary lifestyle. To encourage a sense of ownership of livestock, (1) utilize any traditional sharing mechanisms to gain a match from the local community and (2) involve recipient households in the selection animal species and actual stock.

Practice: Optimize herd composition to maximize pastoralist's capacity to cope with an unpredictable environment (Mace 1988). This involves generating sufficiently high output (e.g., meat or milk products) to meet household needs without jeopardizing the long term capacity of the land to support that level of output. This tradeoff is illustrated by the choice between camels and smaller livestock; cattle and sheep multiply faster than camels, but camels are more resilient than cattle and sheep in the face of drought. A mix of ground-level grazers (cattle and sheep) and browsers (camels and goats) maximizes the carrying capacity and productivity of rangelands (UNHCR 1998).

Practice: Facilitate local stock improvement through crossbreeding to infuse improved traits (e.g., animal size, body type or milk-producing capacity) into local animal breeds without losing the resilience of those breeds. Such improvements are advantageous as long as the resulting animals are well-adapted to the local environment. Boran or Sahiwal cattle breeds can be crossed, for instance, with East African short-horn zebu to improve beef and/or milk production under dry conditions. Other animals to consider in crossbreeding efforts include Galla goats (for milk production) and Black-headed Persian sheep (for heat tolerance).

Water harvesting and utilization technologies

Pastoralists typically live in dry areas where the scarcity of water limits livestock and crop production. Below are practices that increase water availability.

Practice: Construct water-holding structures that hold rainwater for livestock or agricultural use, as well as to provide reliable sources of drinking water. Structures that are particularly relevant to pastoralists are:

- Sand dams: These are essentially above-ground aquifers that retain water with minimal evaporation. In ECHO *TN* 70, Jacob and Alvera Stern describe how to involve communities in sand dam construction.
- Small dams or water holding structures such as hafirs. A "hafir" (pictured here) consists of a trench that is lined and covered with plastic sheeting that collects surface rainwater for irrigating small vegetable gardens (Global Service Corps 2008) or to provide drinking water for livestock (El Hadary 2012).

Practice: Adopt rainwater harvesting techniques that minimize erosion while keeping as much rainfall on the land versus being lost to surface runoff. Agricultural approaches include:

- Protect sloping land from erosion through the use of terraces, stonebunds, Sloping Agricultural Land Technology (SALT) gabions, demi-lunes or other similar methods.
- Zai pit system in which seeds are sown into micro-pits (called "zai") that trap rainwater and concentrate moisture and fertility close to plant roots. Stone bunds along contours can be combined with zai pits to increase the amount of rainwater retained on the land.

Practice: Incorporate appropriate technologies to purify water for drinking or home use. Examples of such technologies include biosand filters, Aqua Clara and Sawyer microfiber filters, and solar disinfection (SODIS) of water in plastic bottles left in the sun. Maintain basic hygiene while conserving water by using the locally-appropriate Tippy-Tap (see "For Further Reading" section for more details on these technologies).

Farming in pastoral areas

In many instances, lands where pastoralists live are best managed as pasture land. Nevertheless, for various reasons, many pastoralists have found it necessary to grow crops instead of or in addition to being herdsmen. Below are ideas for assisting pastoralists in growing crops.

Practice: Promote crop production systems that are compatible with dryland ecosystems and/or the pastoralist way of life. Consider systems such as the following:

- Foundations for Farming (also known as Farming God's Way), a method in which farmers keep the soil covered, minimize soil disturbance, and maximize nutrient efficiency through crop rotation and through target applications of inorganic or organic fertilizers in permanent planting stations. These methods also minimize water requirements.
- Zai pit and SALT systems as mentioned in the previous section. Dimensions (depth/width) and spacing of the planting basins in the zai system can be adjusted, for instance, for production of multipurpose trees for animal fodder. Where SALT is used to stabilize hillsides, crops can be grown in between the hedge-rows. The SALT system was developed in the humid tropics; however, the species and spacing of trees can be optimized for dryland areas.

Zai pits with stone bunds. *Photo by Chris Reij.*

Practice: Promote crops suited to dry areas. Consider indigenous crops, dryland fruits (e.g., Jujube [*Ziziphus mauritiana*]) and/or drought-tolerant crops such as cassava, cowpea, sorghum, millet and sweet potato.

Practice: Provide options for producing vegetables. Vegetables provide nutrition and can be grown on small plots of ground, often close to people's dwellings, that can be protected from livestock grazing. Consider the following as options for introducing gardening to an area:

- Sack or bag gardens where very little space is available
- Deep-dug beds for coping with hard pans, managed biointensively to minimize capital-intensive inputs and build soil biology
- Hafirs, as mentioned above, for irrigation of small gardens

Practice: Provide Integrated Pest Management training and promote post-harvest technologies to improve the quality of harvested agricultural products.

Utilizing energy sources appropriate for dry areas

Practice: Use appropriate technologies to increase the efficiency of existing fuel sources. Options include:

- Use of cattle manure to produce biogas for cooking or lighting. An ECHO *TN*, "Methane Digesters," explains several low-cost designs including a simple barrel system. An organization called SNV developed a biogas digester that uses less water than a more typical fixed-dome design (see "For Further Reading" section).
- Converting low-cost materials such as small woodchips, sawdust, or plant waste (composted for 2-3 weeks) to briquettes that can be used as an alternate fuel to firewood and charcoal.
- Use of fuel-efficient cook stoves to reduce the amount of fuelwood needed and smoke produced (*EDN* 85).

Practice: Utilize solar energy where possible. Energy from the sun can be used for lighting and charging batteries/phones. An organization called Global Cycle Solutions has a presence in Tanzania, helping to make simple electronic conveniences more accessible in rural areas. Solar cookers have limitations, the primary drawback being that they do not work in cloudy weather or at night.

Reducing food losses through appropriate storage and utilization

Practice: Develop low-cost, grain storage structures such as earthen or metal grain silos. The ability to store grain for long periods of time increases the options pastoralists have in terms of managing food resources for consumption or marketing purposes. They could, for example, purchase grain immediately after harvest when prices are low, and then sell some or all of their stored grain at a later time when prices have risen. Grain storage options include:

- A household grain storage structure developed by Global Service Corps that holds 10-11 100 kg sacks of maize and costs $57 for materials other than sand and bricks (EEAS 2013 Day 3 presentation, "Household Grain Storage").
- Metal grain silos that can be fabricated by local artisans. Initial investments for building these typically range from US$30 to US$100 (see *EDN* 112 and Postcosecha's website).

Practice: Implement technologies to dry and store wild vegetables and fruits. This can lead to income generation opportunities. Drying technology interventions should be accompanied with training and information on how to reconstitute dried food into locally acceptable, tasty meals. Drying options include:

- A solar dehydrator described in ECHO *TN* 41, "Solar Dehydrator"
- A low-cost food drying approach, developed by Global Service Corps, and described in "14 Innovations for Dryland Food Security," a pdf available in the East Africa section of ECHOcommunity (see "Outside Resources")
- Small-scale drying technologies promoted by Practical Action

Practice: Facilitate village-level milk processing and meat preservation. This creates income-generation opportunities using resources that pastoralists have an abundance of. The FAO has written extensively about this (see "For Further Reading" section)

Encouraging socio-cultural change

Below are practices to consider for empowering pastoralists to address social challenges (mentioned in the "Introduction" section of this document).

Practice: Root change practices within a strongly-held worldview. A biblical worldview addresses many of the social challenges faced by pastoralists. For example, see Roger Sharland's presentation entitled "A Biblical Basis to Motivate Rural Change" (2013 EEAS Day 3).

Practice: Encourage social entrepreneurship. This involves facilitating local business enterprises that improve livelihoods while empowering those in need to bring about positive social change. Markets for livestock can be improved through (1) regularly-held (e.g., weekly) auctions close to community clusters and (2) information systems to raise awareness of prices, disease outbreaks and animal movements. In addition, provide business opportunities such as milk processing, meat preservation, drying hides/skins and beekeeping.

Practice: Set up village cooperative banks to strengthen rural communities and provide a structure for equitable means to accrue and access financial resources. There are numerous models for doing this, several of which are highlighted in the "For Further Reading" section.

Practice: Provide education on nutritional diversity, adding new sources of nutrition to local diets, while also recognizing the value of indigenous foods. This can help to address intra-household food disparities.

Literature Cited

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For Further Reading

About Pastoralism in General

FAO. 1990. Community Forestry: Herders' Decision-Making in Natural Resources Management in Arid and Semi-arid Africa. Community Forestry. Note No. 4. Rome. http://www.fao.org/docrep/t6260e/t6260e00.HTM

Arid Lands Information Network (ALIN) through *Baobab* magazine provides high impact options for interventions.

Tearfund "The impact of climate change on nomadic people."

LEGS. 2009. Livestock Emergency Guidelines and Standards. http://www.livestock-emergency.net/userfiles/file/legs.pdf

Improving rangelands in pastoral areas

IEED. 2010. Participatory Land Use Planning as a Tool for Community Empowerment in Northern Tanzania. Ujamaa Community Resource Team. This features a highly participatory method that ensures whole village buy-in to the natural resource plans, increasing the likelihood that a community will adhere to the bylaws that are created. http://pubs.iied.org/pdfs/14608IIED.pdf

Appropriate systems compatible with pastoralism

- Farmer Managed Natural Regeneration (FMNR)
  - *TN* 65
  - "Farmer Managed Natural Regeneration (FMNR): A Good News Story for a Deforested and Degraded World"

- Farmer Managed Agroforestry System (FMAFS)
  - *TN* 60
- Zai pit system
  - ECHO book, *Agricultural Options for the Poor* (pg 114)
  - Video entitled *The Man Who Stopped the Desert*
- Holistic Management (HM) organizations:
  - Africa Centre for Holistic Management
  - Savory Institute

Improving livestock management in pastoral areas

Involving community animal health workers

- *Animal Health: Best Practices from FARM-Africa's Pastoralist Development Project in Kenya*
- *Agrodoks* available for purchase at www.agromesia.org, such as "Ethnoveterinary Medicine"

Managing common diseases affecting livestock

- *East Coast Fever Immunization* presentation (Lynen and Di Giulio, 2013 EEAS Day 2)
- Newcastle Disease
  - "Rural Poultry Systems & Newcastle Disease Control" presentation (Alders, 2013 EEAS Day 2)
  - *EDN* 118

Managing herd composition

Restocking Pastoralists: A Manual of Best Practice summarizes the concept of restocking of livestock and contains links to decision-making materials.

Encouraging social entrepreneurship

- "Omasi Engiteng Dairy Social Enterprise" presentation (Ole Mongoi, EEAS 2013 Day 2)
- Processing milk, blood and meat locally. Some helpful resources:
  - Livestock Stakeholder Self-Help Association (LISSA) in Kenya
  - *Red Meat for Local and Export Market*, analysis by SNV, Tanzania
  - A radio show about modern processing of milk from Maasailand
- Dry hides and skins, as described in these online publications:
  - *Manual for the slaughter of small ruminants in developing countries*, an FAO publication
  - Wayua, F.O. and A Kagunyu. 2012. Constraints and Opportunities in the Hides and Skins Value Chain in Pastoral Areas of Northern Kenya. Kenya Agr Res Institute, National Arid Lands Research Centre. www.lrrd.org/lrrd24/8/wayu24135.htm
- Introduce bees using different types of hives.
  - Beekeeping in the context of development
  - Adjare, S. 1984. The Golden Insect: A Handbook on Beekeeping for Beginners. London, Intermediate Technology Publications. http://www.scribd.com/doc/36993742/The-Golden-Insect-a-Handbook-on-Beekeeping-for-Beginners-1984

Farming in pastoral areas

Crop production systems

- Foundations for Farming
  - *TN* 71
  - Foundations for Farming website, http://www.foundationsforfarming.org/
  - Farming God's Way website, http://www.farming-gods-way.org/
- Zai pit system
  - *TN* (in press)

- Kaboré D. and C. Reij. 2003. The Emergence and Spread of an Improved Traditional Soil and Water Conservation Practice in Burkina Faso Conference Paper No. 10: InWEnt, IFPRI, NEPAD, CTA conference, Pretoria. http://www.ifpri.org/sites/default/files/pubs/events/conferences/2003/120103/papers/paper10.pdf

Drought-resistant crops

- *Africa's Indigenous Crops*
- *Expanding Valuable Harvests, Creating Viable Employment*, a PDF file by the United Nations Development Programme that discusses livlihoods derived from Burkina Faso's non-wood forest crops such as Gum arabic and Balanites.
- Ogbazghi, W. and E. Bein. 2006. Assessment of Non-Wood Forest Products and their Role in the Livelihoods of Rural Communities in the Gash-Barka Region, Eritrea. A Drylands Coordination Group pdf with lists of dryland plant species
- Articles providing insights from failed attempts to irrigate croplands that are probably better suited for grazing.
  - *Choosing Crops Over Cattle: Are African Governments Taking Pastoralists Seriously?*
  - *Hidden Cost is Value Lost: The Economic Importance of Dryland Goods and Services in the IGAD Region*

Gardening/agricultural options

- Sack or bag gardens
  - "A Garden in a Sack: Experiences in Kibera, Nairobi," an article in *Urban Agriculture* magazine (number 21; January 2009)
  - More information about bag gardens, http://www.sendacow.org.uk/lessonsfromafrica/resources/bag-gardens
- Biointensive deep dug beds ("Publications" under "English Resources" within the East Africa section of ECHOcommunity.org)
  - "Deep Dug Bed Guide"
  - "Bio-Intensive Agriculture, BIA"
- Other sources of information on agricultural interventions in pastoralist areas
  - SPORE/CTA has reported on interventions pertaining to pastoralists
  - Footsteps
  - Farming Matters/ILEIA
  - Farm Radio Network occasionally has items of interest to pastoralists, and support for radio broadcasts appropriate to pastoralists
  - Free publications from the International Institute of Environment and Development (IIED).
    - Publications and papers, http://pubs.iied.org/search.php?c=drylands/pastoral
    - Helpful books such as *Modern & Mobile: The Future of Livestock Production in Africa's Drylands*; 88pp.
  - Reijntjes, C., Haverkort, B. and Waters-Bayer, A. 1992. Farming for the future: An introduction to low-external input and sustainable agriculture. Leusden, the Netherlands, Macmillan, ILEIA.250 pp. How development workers can assist small-scale farmers in making the best use of low-cost local resources to solve their agricultural problems. Table of Contents available.

Utilizing appropriate energy sources

Biogas systems

- "Methane Digesters" (Appropriate Technology *TN* 44)
- A biogas model for dryland areas, developed by SNV, which produces methane gas using much less water than the typical, traditional fixed dome biogas digester

Cooking options

- "Briquette Presses for Alternate Fuel Use" (Appropriate Technology *TN*)
- "Sawdust Cookstove" (Appropriate Technology *TN* 40)
- UNHCR. 2002. Conservation and Alternative Fuels. UNHCR, Geneva.Cooking Options in Refugee Situations: A Handbook of Experiences in Energy Conservation and Alternative Fuels. http://www.unhcr.org/406c368f2.html

Solar energy

Global Cycle Solutions: Improving Village Life through Quality, Affordable Technology (with a subsidiary in Tanzania).

Reducing food losses through appropriate storage and utilization

- *Pastoralist Field Schools* is an approach to help communities address pest-related factors influencing food losses.
- Improving grain storage:
  - "Household Grain Storage" presentation (Global Service Corps, 2013 EEAS Day 3)
  - World Food Programme Training Manual
  - View current research from University of Greenwich
- Food dryers:
  - "Solar Dehydrator," Appropriate Technology *TN* 41
  - Practical Action
  - FAO document outlining steps in drying fruits and vegetables for income generation
- Milk processing:
  - FAO. 1988. Village Milk Processing. FAO Animal Health and Production Paper No. 69, Rome. http://www.fao.org/docrep/004/t0045e/t0045e00.htm
  - FAO. 1990. The Technology of Traditional Milk Products in Developing Countries. FAO Animal Health and Production Paper No. 85, Rome. http://www.fao.org/docrep/003/t0251e/t0251e00.htm
- Meat preservation:
  - FAO. 1990. Manual on simple methods of meat preservation. FAO Animal Health and Production Paper No. 79, Rome. http://www.fao.org/docrep/003/x6932e/x6932e00.htm

Encouraging socio-cultural change

- Information on change practices rooted in a biblical worldview
  - Various projects undertaken by a private group in Tanzania: www.massai.org
  - "A Biblical Basis to Motivate Rural Change" presentation (Sharland, 2013 EEAS Day 3)
- Village-cooperative banks
  - "The Savings Group Model" (*EDN* 115)
  - "Village Community Banks Strengthening Rural Groups" presentation (Banzi and Ukio, 2013 EEAS Day 3)
- Intra-household food disparities
  - "Focusing Food Security Initiatives on the Marginalized" presentation (World Education, 2013 EEAS Day 3)
  - "Addressing disparity through increased nutritional diversity," Chapter 4 of ECHO's book, *Agricultural Options for the Poor* is devoted to cropping options for added nutrition. The book can be purchased online from ECHO's bookstore.
- Learn about Land Grabbing, from Slow Food International's extensive resource list, which includes articles, powerpoint presentations, comics, and leaflets.