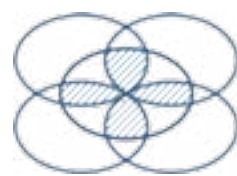


Livestock Breeds in Spate Irrigation



Practical Note Spate Irrigation



Spate Irrigation
Network

Introduction

Livestock is an integral and important component of the livelihoods of households in most spate-irrigated areas. It is an important and stable source of income and saving and a major source of draught power (essential for soil moisture management and earthworks repairs). Spate areas have produced important species, such as Baghnari, Sindhi Red Bull and Loghari goat and sheep in Pakistan (Van Steenberg et al. 2008)

Pakistan, Sudan, Yemen and Ethiopia own large and rich livestock resources which are genetically diverse. Some of the breeds have special merits that meet the specific requirements of the semi-arid regions where spate irrigation take place. Well-adapted local breeds that are kept without special feed concentrate or preventive health care, are now increasingly recognized as being more productive than imported exotics (Kakar 2009). Often the ability of livestock to survive natural calamities (droughts, climatic extremes) is more important than high productivity.

However these precious and important livestock breeds are currently under threat. Of the estimated 6400 breeds of farm animal species worldwide, about 30% are endangered and 1% becomes extinct every year (Scherf, 2000). Diseases, urbanization and cross breeding, lack of valuation and selective breed programs of local breeds, increasing competition for natural resources, environmental degradation and lack of fodder are factors that are threatening those breeds.

There is utmost need to characterize and document livestock breeds, because there is little information on the history and relationships of most livestock breeds. This practical note gives an overview of the livestock breeds in spate irrigated areas of Eritrea, Ethiopia, Pakistan, Sudan and Yemen. It aims at understanding



Figure 1: Oxen in a spate irrigated area, Sheeb, Eritrea.

the local production and breeding systems and constraints. By giving an overview of the breeds most common in the different spate irrigated areas it is hoped that the beginning of an exchange program can start. Finally recommendations are given that can increase the livestock productivity in the spate irrigation areas.

Eritrea

Agriculture is the main stay of the economy, accounting for 20% of the country's Gross Domestic Product (GDP) and almost all rural employment. Smallholders account for over 90% of agricultural outputs. Over 80% of rural households own livestock (IFAD 2011).

Reliable statistics are lacking on current livestock populations. No livestock census has been carried out since 1978, and the current livestock figures are based on estimates. According to these 1.9 million cattle, 2.1 million sheep and 4.7 million goats were in the country in 2012 (Ministry of Information 2012).

The most common type of livestock reared are camels and goats. Oxen are kept in spate irrigation areas to construct and maintain temporary diversion structures and field embankments and to till the land, including deep ploughing and mulching. Small ruminants serve as a buffer to overcome dry years (Tesfai & Stroosnijder 2001) The indigenous livestock and their characteristics are shown in Table 1.

Transhumance is common in Eritrea. For instance in Sheeb, agropastoralist farmers take thier families and livestock to the uplands in the summer to return in the winter period to the spate systems of the lowlands.

There is a slight difference in the breeding selection and strategies of farmers in the highlands and pastoralists in the lowlands. Breeding selection and strategy in the highlands focuses on the bull, the purpose being to produce a hardy working bull. Currently, most of the work oxen in the highlands are cross-overs between the small highland small docile, breed in the area and the bigger, pastoralist breed 'Ershay' which is known as 'Begait' in the highlands. The cross-bred is known as 'Medenes'. The cross-bred is thought to be of a better working capacity (Andom 2003).

Pastoralists select a bull based on the milk productivity of its mother and grandmother. Characteristics for assessment include not only milk

Type	Landrace	Characteristics
Cattle	Arado	Small body size, medium sized horns, low in milk production, adapted in all areas
	Begait (Barka)	Larger body size, short horned, good meat and milk production, adapted to low lands
	Bahri	Large body size, small horns, excellent milk and meat production, adapted to lowlands
Sheep	Bahria (Kirchie)	Flattened fatty and short tail, high milk yielding (3lt/day), 2 lambing /year
	Tsaeda (Hamadi)	Long tailed, tall stature, high milk production, high market demand, low feeder
	Barka (Begait)	Tall, long tail, consume are large amount of feed, good meat and milk production
	Kaieh	Short stature, low in milk, good meat producer
Goat	Zhe	White colored, reproductive efficiency, preferred for meat, adapted to lowlands
	Ware	Black colored, adapted to lowlands
	Tzaadit	Medium sized, high milk yielder, 2-3 lit/day, high market demand

Table 1: Indigenous livestock and their characteristics of Eritrea (Source: Haile 2003).

but also meat and walking ability (as they go for long-range grazing) and aesthetic values. Not only do they do this as routine, but they also have proved that they can quickly adapt to unforeseen circumstances (Andom 2003). However livestock productivity in Eritrea is low due to shortages of feed and water, and problems with pests and diseases (IFAD 2011).

The sources of livestock feed are green fodder and dry stover for cattle. Goats and sheep browse at the riverine areas and foothills. However in the spate irrigated areas of Sheeb, there is in the dry season a shortage of animal feed. Farmers' strategies implemented at times of feed shortages are moving animals to other areas (53,6%), reducing the quantity of livestock (9,3%) and purchasing additional feed (32,5%) (Haile 2003). Further households in the Sheeb area in Eritrea practise 'zero-grazing' from October to May, whereby the animals are fed

with cut grass from the fields, to prevent livestock from causing damage to standing crops and to economize on the scarce animal feed (Van Steenbergen et al. 2010).

According to Haile (2003) The main constraints in livestock production in spate irrigated areas are feed shortage (26%), drought (22,3%), water shortage (17,4%), shortage of grazing areas (15,2%) and animal diseases (13,4%).

The major livestock diseases are ecto- and endo-parasites, trypanosomiasis, mange, sheep pox and pasteurellosis. The main control measure is annual vaccination. Some farmers and pastoralists practice traditional medicine using herbs (Haile 2003). An improvement in veterinary services is the training and mobilizing of communal animals health workers (CAHWs) under the Eastern Lowlands Wadi Development Project (see box 1).

Box 1: Paravets in Eritrea

In the Eastern Lowlands Wadi Development Project considerable attention was paid to mobilizing Communal Animal Health Workers (CAHWs). All in all, 36 CAHWs were trained, were paid a monthly incentive of 400 Nkf and were provided with a veterinary kit. The CAHWs reported to local veterinary clinics. The CAHW programme proved highly effective. The Ministry of Agriculture estimated that approximately 90 percent of total treatment in the project area was carried out by the CAHWs. This was confirmed in farmers interviews. Not only did remote villages now have access to basic animal health services, but farmers reported that in contrast to before, when they had to travel long distances to reach the clinics, they seek help from the paravets before diseases turn critical. Of importance to the farmers is also that many of the CAHWs travel to the highlands. On this way, continuous livestock health support in the communities is thus provided. However, interviewed farmers and CAHWs alike stressed that the supply of drugs to the CAHWs was at times a constraint. Further the lack of access to storage facilities had an adverse effect on CAHWs services and earnings. Lastly, both interviewed farmers and paravets expressed desire for further training of the paravets, for example in fodder management and production.

Regions	Cattle	Sheep	Goats
Ethiopia	49.297	25.017	21.884
Tigray	3.103	1.376	3.107
Afar	473	403	801
Amhara	12.748	8.987	6.022
Oromia	2.245	9.098	7.439
Somali	620	1.162	283
Benishangul Gumuz	411	84	321
SNNPR	9.263	3.838	2.626

Table 2 Population of cattle, sheep and goats in the Ethiopian regions. (Source: CSA survey (2008/09)).

Ethiopia

Livestock are of economic and social importance both at the household and national levels. It has provided significant export earnings in the past. Livestock contribute 15 to 17 percent of GDP and 35 to 49 percent of agricultural GDP. The large variations are due directly and indirectly to climatic variation (GebreMariam 2010). It was estimated that approximately 49 million cattle, 25 million sheep and nearly 22 million goats were in the country in 2008 (CSA 2009). Table 2 shows the population of cattle, sheep and goats in the Ethiopian regions.

Cattle breeds in Ethiopia are almost entirely of the zebu type. Indigenous cattle breeds are a key to sustaining the wellbeing pastoral communities, predominantly inhabiting low-input production systems. The country has over 24 cattle breeds or populations, which can be grouped into four categories: zebu (*B. indicus*), sanga (zebu × *B. taurus*), zenga (sanga × zebu), and the humpless *B. taurus* (Rege, 1999). The extent to which the exotic genotypes have diffused into the indigenous populations and the level of dilution is not objectively assessed. But, available estimates indicated that crossbred cattle make only 1% of the total cattle population of Ethiopia (Institute of Biodiversity Conservation 2004).

Almost all sheep and goats in Ethiopia are indigenous; several breeds have been identified but are less clearly differentiated than cattle. These have evolved in-situ under various, but universally harsh, conditions of health care, feeding and management and often of climate. Their output is low and have not been systematically improved but is probably capable of being improved if better circumstances are provided (Mengistu 2003). Table 3 (see next page) summarizes the landrace, habitat and characteristics of indigenous cattle, sheep and goat that can be found in spate irrigated areas of Ethiopia.

Spate irrigated areas in Ethiopia are found in the highlands, where farmers focus on mixed crop-livestock systems, and in the lowlands, where pastoralists are dominant. In the mixed crop-livestock system of the highlands, cattle are used primarily for draught power and dairy. Meat production is secondary, and thought to involve mainly old and unproductive animals such as retired draught oxen. The pastoralists in the lowlands use cattle primarily for dairy for household consumption, with the result that the majority of the herd is female. The key interaction between the mixed crop-livestock system in the highlands and the pastoralists in the lowlands is the sale of male calves from the



Figure 2-3: Goat and sheep herds, Ethiopia.

Type	Landrace	Habitat	Characteristics
Cattle	Boran	The Borana plateau of southern Ethiopia, stretching from the Liban Plateau to the extreme southern part of Ethiopia (Rege 1999)	Basically a beef animals, with large and wide frame; weighs up to 500 kg; it is also a good milker providing most of the staples for the pastoral community. The breed is well adapted to semi-arid tropical conditions, has a high degree of heat tolerance, is tolerant to many of the diseases prevailing in the tropics and has the ability to survive long periods of feed and water shortage (Ojango et al. 2006).
	Sanga (Danakil and Raya Azebo)	Ethiopia and environs is considered to be the centre of dispersal of the Sanga. The breeding area of the Danakil is the Awash River Valley (Harer and Shewa, in Wello, parts of Tigray and Afar, stretching into parts of Djibouti). Raya Azebo is found east of Lake Ashangi in Tigray and bordering areas of Wello, particularly in the northern parts (Rege 1999).	Sanga cattle vary in size from very small to large. The head is usually long, moderate in width with a convex or straight profile. The horns vary greatly in length, base circumference and orientation. (Rege 1999)
	Zenga (Arado, Horro)	Beyond the borders of the Sanga breed, extending into southern Eritrea (Rege 1999).	Locally called Horro. The Horro are very good looking animals being uniform in color and body conformation. They are of medium to large size, with small and finely shaped head, a straight profile and medium to large horns. The hump is small to medium in size. The Horro cattle have a uniform brown color which is slightly lighter around the muzzle and on the flank.(Hassen et al. 2007)
Sheep	Afar	Afar Region and the dry areas of the Rift Valley	Afar breed is fat tailed but with a very different shape (shield shaped and descends to the hocks with short S-shaped upturned tip) with no wool. The Afar sheep is a hardy breed adapted to drought prone arid and semi-arid areas of the middle Awash valley of eastern Ethiopia which includes the coastal strip of the Danakil depression and the associated Rift Valley in Ethiopia. (Getachew 2010)
	Bonga	South Western part of Ethiopia	The tail is wide and long. Both male and female are polled. The ear is long, the hair is short and smooth. The breed is judged as good for traits like growth rate, meat quality, fattening potential, twinning rate and temperament (Edea 2008).
	Horro	Western part of Ethiopia mid-highland region (i.e. 1600 to 2800 m altitude)	A fat-tailed hair type sheep with bigger growth potential compared with other indigenous breeds in Ethiopia (Getachew 2010).
	Menz	The Ethiopian highlands with an altitude range of 2700 to 3300 m.a.s.l.	One of the few coarse woolly fat-tailed sheep types, adapted to high altitude precipitous terrain with scarcity of feed and where production of crop is limited ue to extreme low temperature and drought in cool highlands. This is a hardy small breed which controls level of internal parasites infection and is productive under low input production circumstances of the degraded ecosystem (Getachew 2010).
Goat	Somali (Ogaden, Mudugh, Boran)	Ogaden, Elkere	Medium size with long legs, adapted to dry areas; short smooth hair with brilliant white colour; with patches of Brown on shoulder and neck; ears short and never pendulous; convex facial profile; milk yield is good (Ayalew 1992)
	Adal (Afar, Danakil)	Northern Rift Valley, in Wollo and Northern Hararghie	Typically white but some are grey, black or mixed in colour; skin and meat type; smaller to Somali goat (Ayalew 1992)

Table 3: Landrace, habitat and characteristics of cattle, sheep and goat in Ethiopian spate irrigated areas.

lowlands to the highlands for draught power and eventually, for fattening (Gebremariam 2010). Farmers and pastoralists objectives of keeping sheep and goat are cash income, savings and meat for household consumption (Gizaw et al 2010). There is a huge potential to develop lowland spate irrigation systems in Ethiopia: if this is to happen the livestock breeds would need to adjust as well – to cater for the larger demand for draught power. The breeds as common in Pakistan’s lowland (such as the Sindhi Red Bull and the Bhag Nari cattle) would then need to be considered.

It is estimated that natural pasture provides from 80–90%, and crop residues 10–15% of the total livestock feed intake in Ethiopia (Alemayehu 2003). However, feed shortages are reported to be pervasive and persistent. Pastoral herd size (including survival and reproduction) is fundamentally constrained by lack of grazing and water and periodically reduced 20-60 percent by chronic drought. In the relatively wet highlands, available livestock feed (including grazing) is estimated to fall 40 percent short of requirement. (Gebremariam 2010).

The common livestock diseases identified include sheep and goat pox, liver fluke (fasciolosis), Pasteurellosis, PPR (peste des petits ruminants), trypanosomosis, mastitis and blood urine. Biting flies prevent cattle from grazing during the day. This is especially taken place when temperature is high (Gebremedhin et al 2007). However veterinary services are not available for the vast majority of livestock owners. The few public clinics are located in major towns and provide the services mostly to cattle owners around these towns. The animal health staff are small in numbers and cannot cover a large area. Fortunately there is traditional veterinary services. Traditional healers are using herbs as medicine and incising abscesses and wounds.

Administrative Unit	Cattle	Sheep	Goat
Pakistan	29.558.812	26.487.741	53.786.988
N.W.F. Province	5.967.886	3.363.249	9.599.017
Punjab Province	14.412.323	6.361.767	1.983.039
Sindh Province	6.925.022	3.958.508	12.572.221
Balochistan Province	2.253.581	12.804.217	11.784.711

Table 4: Population of cattle, sheep and goats by administrative unit (Source: Pakistan Livestock Census 2006)

Pakistan

Livestock is an integral part of the farming systems and rural economy of Pakistan. Livestock has a dominant share of 55.4 percent in the national agricultural economy and grew 3.7% percent during the year 2012-13 (Pakistan economic Survey 2012-13). In spate irrigation areas livestock also plays an important role. Table 4 shows the population of cattle, sheep and goats by administrative unit.

All the indigenous cattle of Pakistan belong to zebu (humped type) cattle (*Bos indicus*) (Khan 2008). Cattle are important for land husbandry and they are an asset for average and poor farmers. Goats and sheep are mainly important as a source of cash income, but they are also kept for their milk, wool, skin and manure. By-products of milk such as yogurt, ghee, cheese and cream are the essential part of diet among the rural population.

Goats are considered resistant to drought and harsh climatic conditions. Sheep are relatively less resistant. That is why farmers keep sheep on a smaller scale. In DI Khan, both sheep and goats were of local Damani breed. Farmers were reluctant to keep other breeds, because experience has shown that improved breed of goats and sheeps brought from other parts of Pakistan could not thrive in the harsh environment of spate irrigation areas with poor feed supply especially of the grazing land. Table 5 summarizes the landrace, habitat and characteristics of the indigenous cattle, sheep and goats that can be found in spate irrigated areas of Pakistan.

Government Livestock Farms in all the provinces are serving as models for farmers to raise livestock. Not all breeds are preserved and propagated at these farms but they have played their role in conserving some sheep and goat breeds such as Karakul, Hissardale and



Figure 4: Red Sindhi bull, Pakistan.

Type	Landrace	Habitat	Characteristics
Cattle	Bhagnari	Balochistan Province	Typical animals are massive with compact and well-proportioned body and limbs. Body color is white or grey, deepening to almost black on the neck, shoulders, and hump in mature males. They have a medium-sized head with a short, strong neck. Other characteristics include a small dewlap; small pointed ears; stumpy horns; medium-sized hump; straight back; wide, muscular, and drooping hindquarters; and black tail switch. The cows are low milk yielders. Adult males weigh 450-600 kg, while females weigh 325-425 kg. They have the potential to grow about 1000 kg (for male). Males are suitable and excellent for heavy draught work.
	Lohani	Balochistan Province	Lohani cattle are small-sized and short-statured. Body colour is red splashed with white spots. They have short thick horns, small ears, a short neck, well-developed hump, moderate dewlap, black tail switch, small tucked-up udder, and a low milk yield. An adult male weighs 300-350 kg and female 230-280 kg. Lohani cattle are very hardy and sure-footed; male stock is suitable for light work in hilly and subhilly areas. Cows produce 800-1000 litres/lactation.
	Dajal	DG Khan	The Dajal breed is considered an offshoot of the Bhagnari breed, having similar features. However, Dajal cattle are comparatively smaller in size and lighter in color. Cows are low milk yielders. The breed is used for draught work. Males are as good for draught work as are those of the Bhagnari breed.
	Rajhan	Common in the spate irrigated areas of Rajanpur and the surrounded areas at the conjunction of Punjab, Sindh and Balochistan	Rajhan cattle are small-sized animals with a red and white spotted coat (considerable variation in spot size), tight skin, small and alert ears, small pointed horns, short neck, proportionately large hump, and extended dewlap. Their thin tail usually ends in a white switch. They have a small, tucked-up udder. Milk yield is very low. The adult male weighs 300-350 kg and the female 230-280 kg. Male stock is very suitable for draught work in hilly and sub hilly areas. It can survive under difficult situations when fodder production decreases in the off season.
	Red Sindhi	Western Sindh and Lasbella district, Balochistan	A medium-sized breed with a compact build and red body colour. A dairy breed with a milk yield per lactation from 1200 to 2000 litres. Adult male weigh 400-500 kg and the female 300-350 kg. Adapt very well to stressful environments.
Sheep	Balochi	Kalat and part of Quetta division. Thinly populated in Bolan district of Balochistan province.	White body and black, brown, or spotted muzzle and legs, are medium in size, and their adult male and female weights are 37 and 32 kg, respectively. The male has a slightly Roman nose and horns. The fleece is white with pigmented head and legs. The wool is coarse with modulation and mostly used in carpet industry (Jahan et al. 2012)
Goat	Barbari	Kullachi district of Balochistan province	A small, compact body size. The orbital bone is quite prominent, so that eyes appear bulging. There is wide variation in coat color, but white with small light brown patches, is the most typical. Ears are short, tubular, almost double with the slit opening in front, erect, directed upward and outward. Both sexes have twisted horns, medium in length and directed upward and backward; horn length: 11.17 cm. Bucks have a large thick beard. The average flock contains 9.25 individuals (2 to 31), of which 0.6 adult males, 5.3 adult females and 3.4 young (Kakar 2009).

Table 5: Landrace, habitat and characteristics of cattle, sheep and goat in Pakistan spate irrigated areas.

Pak-Angora. Research programs at these stations have, however, been limited and about 90% of livestock in the country are bred naturally. (FAO 2003).

Areas around flood channels, marginal and fallow lands and lands without sufficient irrigation are grazing areas for livestock. Just immediately after harvest, the fields are used for livestock grazing. The owner and sometimes the tenants have the first right. Nomadic pastoralists have to pay a fee to use the land for livestock grazing. This also concerns the use of water ponds for livestock drinking. The production of fodder is highly important to support the large amount of livestock in the Balochistan region. Farmers sell surplus fodder to nomadic pastoralists. However

rangelands production potential however has decreased manifold because of droughts and over grazing (Kakar 2009).

Shah (2000) recorded some of the common livestock diseases in Balochistan: anthrax, enterotoxemia, hemorrhagic septicemia, black quarter, mastitis, foot and mouth disease, rinderpest, rabies, bovine viral diarrhea, pleuropneumonia, ecto- and endoparasitic problems e.g. coccidiosis, fascioliasis, parasitic gastroenteritis, nasal fly, mange and ticks. Vaccination programs organized by the government are on seasonal basis for major diseases such as Haemorrhagic, Septicaemia and Foot and Mouth Disease. However untimely, limited vaccination, impotent vaccines, limited

disease diagnostic facilities, cost and quality of drugs are commonly talked problems (Malik and Ahmad 1997).

A survey of ICARDA (2010) indicated that feed availability, followed by animal disease, were the major problems affecting livestock production in Balochistan. The respondents of the survey also claimed that a shortage of water resources, drought, degradation of rangelands, and poor marketing affected livestock production.

Sudan

Agriculture production constitutes the backbone of Sudan's economy in terms of its contribution to GDP. Agriculture represents 45% of GDP in 2005, among which, 20% is from livestock production (MAR, 2008). A survey in 2010 done by the Ministry of Animal Resources and Fisheries estimated a total population of 76 million cattle 52 million sheep and 43 million goats in the country (Behnke & Osman 2012). Sudan is characterized by a wide range of climatic zones, and accordingly cattle, goats and sheep are distributed.

Cattle in Sudan are mainly belonging to the Northern Sudan Zebu variety. This variety

comprises the Kenana, Butana and Baggara with the Gash and Arashie cattle strictly found in the spate irrigation areas of the Gash and Tokar delta. Most of Sudan cattle are kept for milk and meat production and some other social purposes. The milk producers represent about 40% of total cattle population. The most important milk producing cattle are mainly Kenana, Butana and some indigenous breeds distributed sporadically among herders. The rest of cattle are meat producers.

Sheep play a significant role in the Sudanese economy as export product. In spate irrigation areas, they contribute highly to food security and are used for sale in times of drought. Goats are scattered all over the delta and graze freely around the settlement. It is kept for milk and meat. Table 6 summarizes the habitat and characteristics of the indigenous livestock that can be found in spate irrigated areas of Sudan.

Rangelands provide about 86% of feed for livestock, crop residues and agricultural byproducts 10%, and irrigated forage and concentrates 4% (Thomson et al. 2000).

In the Gash flood plains, large areas are covered with a variety of annual and perennial grasses through seasonal flooding with excess floodwater

Type	Landrace	Habitat	Characteristics
Cattle	Gash	Gash and Tokar	It produces about 3-4 liters of milk per day around 3-5 months. It is kept mainly for its beef. The average weight of adult cattle is ranging between 200 to 300 kg.
	Arashie (Beja)	Gash and Tokar	It is kept as a dairy breed and can produce up to 10 liters of milk daily for about 5 months. It is a possible variety of the North Sudan Zebu. The breed is adapted to frequent droughts. It is white colored with black spots all over.
	Butana	Tokar	The Butana is typically a dairy animal, producing 700-4 600 kg of milk of 4.5% butter fat in a 220-420 day lactation. Butana cattle are the heaviest Sudanese cattle breed (Rege 1999).
	Bagarra	Khor Abu Habil	The Baggara cattle are originally owned by the Baggara nomadic Arab tribes in the west, central and southern Darfur, central and southern Kordofan and Nuba Mountains, and Suliem Baggara, west of the White Nile. They are typically used for beef (Rege 1999).
Sheep	Sudan Desert sheep or its sub-variety the Gash sheep	Gash and Tokar	The Sudan Desert sheep is kept for its meat. Its weight is between 50-60 kg. It has lop ears, long fleshy tail with broad base. It is predominantly brown but colored is variable. Sudan Desert sheep are generally described as long-legged. The length of the legs is due to management and climate. In the northern ranges where the scarcity of grazing imposes walking long distances, the sheep have developed longer legs and a light body (Mufarrih miscellaneous).
	Hamary sheep	Khor Abu Habil	A sub variety of the Sudan desert sheep.
	Nuba Mountain sheep	Khor Abu Abil. Originally from the Nuban Mountain areas	A white colored, light weighted (approx 11 kg) sheep.
	Banya Garar	Khor Abu Abil	A medium sized cross-bred of the Hamary and Nuba Mountain sheep. It is mainly kept for its meat or for export.
Goat	Sudanese desert goat	Gash, Tokar and Khor Abu Abil.	An fairly large and long-long legged animal with a short coat of light grey color, often splashed with brown or black; typically with pendulous ears of moderate size. Its weight is 30-50 kg. The females are poor milk yielders (Epstein, 1971).

Table 6: Landrace, habitat and characteristics of cattle, sheep and goat in Sudan spate irrigated areas.



Figure 5: Gash cattle, Sudan.

from the Gash River. According to traditional water governance practices, the first flood in the river is diverted to the extremes of the scheme in order to stock drinking-water for livestock and to irrigate the grazing lands, so that animals will be kept away from the planted crops. However, increased mechanized farming activities on traditional grazing lands, as well as the migration of additional livestock herds from other areas, have increased the pressure on the remaining rangelands, which are gradually deteriorating (Van Steenberg et al. 2010).

Interaction between livestock and crops is limited to grazing crop residues after harvest. Fodder crops are not generally grown although animals may be let into crops to forage in periods of feed shortage. This can be a source of conflict and other farmers may retain guards to protect their field crops until grain harvest (IFAD 2003).

Livestock disease and mortality are a major cause of impoverishment for households in the Gash delta (IFAD 2003). The most dangerous diseases for cattle are rinderpest, foot and mouth disease, Anthrax, Black quarter, Tick and FMD. Small ruminants disease include, anthrax, sheep pox, mange and enterotoxemia (FAO 2002). Government veterinary services are weak and recurrent drought and resulting feed shortages

contributes to livestock attrition (IFAD 2003). Sudan is lacking in many aspects of basic information as to animal genetic resources and development. Areas such as national recording schemes, breed societies and clubs, regulations and legislation are very poor. It is rather difficult to organize in any order of priority as to the efforts of congressing them. This is because there are large gaps in knowledge about these breeds (FAO 2002).

Yemen

Agriculture is a major sector of the national economy of Yemen. Livestock are estimated to contribute about 20 percent to agricultural GDP; agriculture was about 17 percent of total GDP, whereas livestock contribute 20 percent in this amount. The rest is from crops. In addition, nearly 80 percent of farms are either pure livestock producing, or mixed. [Ward 2000]. Table 7 shows the population of cattle, sheep and goat that was estimated in 2005 in the Tihama region and other spate areas of Yemen.

Livestock in Yemen are mainly cattle, sheep and goats. There are two Yemeni cattle breeds. One is confined to Socotra Island and is a *Bos Taurus* animal. The other is the Yemen Shorthorn Zebu. The Yemen Shorthorn Zebu occurs all over mainland Yemen and is also common in the spate irrigated areas. There are 11 sheep breeds: Aansi, Sana'a White, Amran Grey, Amran Black, Yemen White, Taiz Red, Dhamari, Rhadmani, Tihami, Marib White and Socotri. Goats breeds are Yemeni Mountain, Taiz Black, Taiz Red, Surdud and Mawri. All cattle, sheep and goats are small. The average adult weight of cattle is 250 kg. Sheep and goats are 25 and 22 kg respectively (Wilson 2003).

Area	Cattle (head)	Sheep (head)	Goat (head)	Total head
The republic of Yemen	1.404.299	7.740.269	7.628.565	16.773.133
Livestock in Tihama region	339.021	937.037	688.460	1.964.518
Livestock in other spate areas	27.572	350.719	392.162	770.453
Total livestock in spate areas	366.593	1.287.765	1.080.622	2.734.980
Livestock in Tihama region in % of total livestock	24.14	12.11	9.02	11.71
Livestock in other spate areas in % of total livestock	1.96	4.53	5.14	4.59
Total livestock in spate areas in % of total livestock	26.11	16.64	14.17	16.31

Table 7: Population of cattle, sheep and goat in Tihama region and other spate areas of Yemen (2005)

Type	Landrace	Habitat	Characteristics
Cattle	Yemeni shorthorn Zebu	All over mainland Yemen	The Yemeni Shorthorn zebu is of medium to small size, with mature males weighing about 340 kg and standing 125 cm at the withers. Females weigh up to 240 kg and stand 110 cm. Horns are never longer than 25 cm. Milk yields are about 600 liters per lactation. The colors are white sandy, red, dark brown or black, with some colors predominating in some areas. A bright red color is probably the most common overall. Male and female animals have darker points. Cattle are used for milk, most of which is converted to ghee and for meat and draught. Draught performance is poor as a results of the light weight, poor nutrition and poor health; a pair of cattle working a 6-hour day ploughs an average of 0.25 ha (Wilson 2003).
Sheep	Dhamari (Burri, Jahrani)	This breed is well adapted to the dry conditions of the uplands of Yemen and uses its tail as an energy store for times of restricted feed supply (Wilson 2003).	The largest and the most distinctive of Yemen's sheep breeds. The average withers height is about 60 cm with males weighing up to 35 kg and females averaging 27-30 kg. The short hair coat is mainly white (Wilson 2003)
	Taiz red (Ganadi, Tajindi)	A sheep of the central-southern part of Yemen extending from the mid-level highlands to the coastal lowlands (Wilson 2003).	Although described as "red" not all animals of the indefinite type are necessarily that colour and there are many other colour and bi-and multi-colour variants. The small size of Taiz red has almost certainly developed as an adaptive trait to the limited feed supply and long dry season (Wilson 2003).
Goat	Taiz black and Taiz red	Central southern, medium altitude highlands (Wilson 2003)	The varieties differ little other than in the base colour: the red variety has a dark muzzle, back line and tail and black knees and hocks. In Taiz, goat milk is used to make the famous Taiz cheese (Wilson 2003).
	Mawr	Central and Northern lowlands of the Tihama region	Mainly white with black marks and patches about the head and forequarters The main production function is meat (Wilson 2003).
	Surdud	Central and Northern lowlands of the Tihama region	Strongly bi-colored red and white. The largest goat in Yemen by a considerable margin, standing 66-68 cm at the withers in females and up to 70 cm in males and weighing as much as 30 kg. The main production function is meat(Wilson 2003).

Table 8: Landrace, habitat and characteristics of indigenous livestock breeds that mainly can be found in spate irrigated areas in Yemen.

Table 8 summarizes the landrace, habitat and characteristics of indigenous livestock breeds that mainly can be found in spate irrigated areas in Yemen.

Animal breeding in Yemen is without structure except in most herds of exotic breeds where animals are bred from within the herd to secure replacement. Some intentional crossbreeding took place in small ruminants only in experimental stations. This structure less breeding is a direct result of the lack of genetic improvement strategy and scientific knowledge thereof (MAI 2002).

In the spate-irrigated areas of the Shabwah Governorate in Yemen, the sale of live animals and livestock products is the main source of income for most households, while the sale of fodder is another important source of income. Crop surpluses are only sold in good years (Ahmad 2000). In Wadi Tuban fodder is the main crop grown in the spate season. It is grown for livestock feeding and for commercial purposes. It is sold on the market of Aden and to other farmers or livestock keepers. (Garcia et al.

miscellaneous) However local varieties of forage are low yielding. High yields can be obtained, provided the necessary inputs of water, fertilizer and disease control are available, but in general they are not (Thomson 2000).

Furthermore production from rangeland is low. As a result of overgrazing, rangeland ground cover is low, with a high proportion of annuals and unpalatable plants. Areas of rangeland with a higher potential for production have been converted into marginal cropping areas, because of the pressure from the increase in human population. Range rehabilitation has concentrated on the enforced exclusion of livestock, using fencing but without involving the local community (Thomson 2000).

Epidemic and infectious disease claims large numbers of livestock each year. Main diseases include Rinderpest, Foot and Mouth Disease, Rift Valley Fever and Sheep Pox. Despite the huge development in the veterinary services, the government assumes responsibility for only a few strategic diseases. Furthermore, veterinary

services do not reach the rural areas. In the past veterinary drugs were given free to farmers, but now due to economic reform, farmers and beneficiaries have to pay for services. (Alabsi 2002).

Recommendations

Livestock support programs, ranging from restocking after drought and providing para-veterinary services to improvement of fodder availability within the irrigation command area, can make substantial contributions to livestock production (Van Steenberg et al. 2010). These examples of livestock production improvements and its impacts are summarized below in table 9 and further elaborated in the subsections. Further improvements such as livestock watering, processing and marketing of livestock products, breeding programs and animal genetic resources conservation are also mentioned.

Fodder and rangeland improvement

Livestock is an integral and important component of the livelihoods of the resident households in most spate-irrigated areas. Access to sufficient fodder is therefore crucial (Van Steenberg & Mehari 2009). Four strategies to improve the fodder production in spate irrigated areas are mentioned below:

- First fodder can be intercropped with legumes. The forage legume provides nitrogen for the cereal and can be weeded and managed together with the cereal without additional labor inputs. The green forage is harvested together with the crop residue, providing a higher quality feed than crop residue alone. Forage legumes can also be planted on fallows to improve soil fertility through nitrogen fixation and leaf drop and then used as feed or planted along the fence and field borders. Fast growing annual forage legumes can be planted after the cereal crop is harvested to produce fodder using the residual soil moisture or during the short rains to use available water when cereals are not planted (ILRI 2013).
- Second floodwater can be used to irrigate rangelands for regeneration of grass and other fodder (shrub) species.
- Third rangeland can be improved with intensive controlled grazing. In intensive controlled grazing (also called holistic planned grazing) the idea is that with intensive grazing for short period in small areas will improve the regeneration of all grasses and

the capacity of the soil to absorb occasional rainfall. The recommendation is to have more cattle – not less – in the dry savannah areas. Instead planned grazing by bunched animals can restore grasslands and add to their productivity as well as biodiversity and capacity to sequester carbon (Knoop et al 2012).

- Fourth livestock fodder market production can be improved and commercialized in order to support farmers in spate irrigation areas and increase cash income from fodder. Processing of fodder products, for instance baling, is an example to improve the efficiency of fodder transport and sales.

Livestock watering

Strategic water points such as improved clay or plastic lined drinking water ponds need to be implemented or rehabilitated to optimize livestock watering. The distance livestock can travel to water while minimizing their impact around the water points need to be taken into account. Furthermore full participation of the local communities in establishing procedures for community maintenance of the water points is important.

Veterinary or para-veterinary services

Farmers, in some cases especially women, need to be taught about the factors transmitting the diseases and parasites and then trained in the administration of vaccines to animals. There are 2 reasons for this.

The first reason is to reduce animal mortality and production losses. For instance in Yemen, annual losses that affect directly farmers through animal mortality is estimated at 20 billion Riyals, (approx. 74 million euro). Direct annual production losses associated with diseases (morbidity) is estimated at about 40 billion Riyals (148 million euro) (MAI 2012). Despite the huge development in the veterinary services, governments in above mentioned countries only take responsibility for a few strategic diseases. Furthermore, veterinary services often do not reach the spate irrigated areas. Knowledge of how to administer vaccines to animals is expected to reduce the incidence of diseases, consequently reducing losses and enhancing household incomes.

The second reason is to improve the position of women in general, particularly (poor) female-headed households, in spate-irrigated areas. The role of women in livestock husbandry should not be underestimated. In Wadi Zabid and Tuban in

Yemen, raising livestock is considered to be the responsibility of rural women and their children. A number of women take care of cows belonging to wealthy households and they share in the cow's production, whereby the first calf will be for the woman. In the spate-irrigated areas of Balochistan (Pakistan), almost all agricultural activities are carried out by women, except the tillage of the land (Lawrence 2005). Special training in vaccination and health care for small ruminants can improve the position of women in spate irrigated areas.

Processing and marketing of livestock products

Improvements in livestock production for small farmers could play a significant role in the food security of households in spate irrigation areas, through increased consumption of livestock products and increased income through sale of animals and dairy products. There are good opportunities to provide additional rural income if markets are developed for underutilized resources, such as skins and wool, and expanded production of by-products, such as cheese.

Breeding and exchange programs

Approaches better adapted to consider the potential of indigenous livestock breeds in spate irrigation areas must be developed. Realistic ways

of improving these breeds must be chosen and applied in the context of environmental constraints and socio-economic demands and within the resources available of spate areas. There is also much potential to exchange breeds between different spate irrigated areas in different part of the world, to carefully introduce new breeds – adapted to the harsh requirements of the spate irrigated systems. It is strongly recommended that an international organizations takes the lead in this.

Animal genetic resources conservation

To better manage, use and conserve animal genetic resources, it is important to understand the nature and distribution of both the phenotypic and genetic diversity that they possess (Rege 2006). Institutions such as International Livestock Research Institute (ILRI) and The Domestic Animal Diversity Information System (DAD-IS) hosted by FAO, are providing searchable databases of breed-related information. By research and trainings they help farmers to exploit the potential of their animals.



Figure 6: Traditional bund intake under construction using draught animals in Eritrea



Figure 7: Hamari sheep, Sudan.



Figure 8: Sudanese nubian goats, Sudan



Figure 9: Butana cattle, Sudan



Figure 10: Yemeni shorthorn Zebu, Yemen.



Figure 12: Surdud goats, Yemen



Figure 11: Dhamari sheep, Yemen.

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Colofon

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