



Community of Practice %Water for Food+

## Water Use Efficiency of Livestock Production

Summary of on-line discussion Oct/Nov 2007

Felix Bachmann, Swiss College of Agriculture, Switzerland ([felix.bachmann@shl.bfh.ch](mailto:felix.bachmann@shl.bfh.ch))

Balz Strasser, Helvetas, Switzerland ([balz.strasser@helvetas.org](mailto:balz.strasser@helvetas.org))

### 1 Introduction

The Community of Practice (CoP) on Water for Food (<http://www.water-for-food.ch>) is a network and discussion platform of interested people who wish to capitalize experience, as well as share and create new knowledge and innovations. The CoP on Water for Food is facilitated by Helvetas in the frame of an Intercooperation-implemented Backstopping Mandate on Water for Food financed by the Swiss Agency for Development and Cooperation (SDC), Division Natural Resources and Environment. The main topic of the CoP is "Sustainable use of water resources for food production within the concept of Integrated Water Resource Management in developing and transition countries". Within this main topic there are many sub-topics which are discussed; these are defined by participants themselves, based on their needs and demands.

In October 2007, the CoP has launched a 3-week online discussion on Water and Livestock, inviting participants to contribute to the main topic of "Water use efficiency of livestock production" with a clear focus on livestock keeping in arid and semi-arid areas. A list of all the contributors is attached to this summary.

This paper is a summary of the discussion held on the topic, and it is foreseen to integrate it as a contribution to the up-coming South-South consultation workshop on the "Role of Livestock in Sustainable Development", which will be held on November 24 & 25, 2007, as part of the International Conference on Environment Education, Ahmedabad, India (<http://www.tbilisiplus30.org/index.htm>).

### 2 Water and Livestock – Initiation and 1<sup>st</sup> round of discussion

The discussion on Water and Livestock was initiated with the following statement:

%Water used for livestock production (directly, or via the production of fodder) is becoming a major reason for water shortage for human use in arid/semi-arid areas. (Hence,) Is livestock production unsustainable if the use of water resource is included in the valuation process?+

## 2.1 Traditional integral role of livestock in arid/semi-arid areas

First contributions immediately pointed out that livestock keeping is a traditional and integral activity in many livelihood systems in arid/semi-arid areas in temperate (Groeli, Tibet)<sup>1</sup> as well as warmer tropical and sub-tropical zones (Haile, Ethiopia)<sup>2</sup>. Most livelihood systems in these areas can simply not be sustained without livestock, and have been environmentally compatible in the past. However, these livelihood systems and with them the animals have in recent years come under increasing pressure due to a depletion of natural resources such as water and vegetation. Reasons for this depletion are population pressure from within these livelihood systems which led to more intensive and/or changed livestock farming patterns with an often unsustainable use of the natural resources, but also changed cropping patterns (Savalia, Gujarat)<sup>3</sup> and expansion of crop land onto land, previously used exclusively for livestock (Peden, Ethiopia)<sup>4</sup>. Water household in arid/semi-arid areas may become even more critical as a result of climate change.

## 2.2 New forms of livestock production in arid/semi-arid areas

Systems are dynamic, and this is also the case for livelihood systems and livestock farming systems in arid/semi-arid areas. As a result of the economic necessity to increase output, but also due to population pressure, livestock production has become more intensive in arid/semi-arid areas, and new forms, ways and means of livestock production have been introduced, though with often adverse effects on the environment.

### 2.2.1 Dairying

One new form mentioned was improved dairying which expanded into semi-arid areas previously seen as unsuitable for intensive dairy activities due to limited availability of water and fodder. It is not only increased milk production with genetically improved dairy breeds (or crossbreds) which requires more water, but also the entire dairy processing industry which is water intensive (Ghotge, India)<sup>5</sup>. Other contributions illustrated how starting dairy activities in an area where agriculture activities have stopped led to a revitalization of the land, the water table and the entire environment (Upriety, Nepal), but also pointed out how turning to more intensive dairying has changed livelihood and increased workload of women (Paudel, Nepal).

<sup>1</sup> The Nomads of West-Tibet, an extremely arid area, depend since centuries almost 100% on their livestock, the famous Yak without depleting the area of water. It is unthinkable how they would survive in this harsh region without their animals.

<sup>2</sup> In the Afar region of Ethiopia, the issue of water is not viewed separately from the livelihoods perspective and we consider it as an ultimate governance matter. Needless to say the pastoralists should be heard and responded to accordingly.

<sup>3</sup> Thus (in Gujarat, India) the increase of the area where bt. Cotton is grown in place of the multipurpose groundnut which was satisfying both needs of farmers, i.e. peanuts for economic earning and fodder for livestock, will lead more unsustainable use of water.

<sup>4</sup> In many dry-land grazing areas, encroaching crop production (..) squeezes livestock keepers into smaller areas making their traditional livestock based livelihoods unsustainable. In effect, competition from crop production has undermined the sustainability of livestock production because there is no longer enough water to produce all the feed animal keepers need.

<sup>5</sup> Ahmednager district of Maharashtra, India receives an average rainfall of 300 mm per year. There are reports from Ahmednagar where from nearby districts tankers supply water to the dairy programmes making the district one of the largest milk producing districts in the state.

Dairying is traditionally practiced in most pastoral communities. They also aim at improving milk production, though their gains might be less spectacular than the ones achieved through sedentary (small-scale) dairy production in semi-arid areas.

When talking about improved, intensive or industrial dairy (or any other agriculture) production, one may recall that improved often means more intensive. However, in most cases, particularly in the agro-climatic zones of arid/semi-arid areas and with the type of production systems prevailing there, improved and hence more intensive systems are still far away from industrial systems; the latter relying heavily on external inputs, often not directly originating from the surrounding areas (Peden; ILRI).

### 2.2.2 Fodder production under irrigation

Most critical for expansion of livestock production in arid/semi-arid areas is the availability of feed and fodder and of water.

In pastoral systems animals follow fodder sources but can be restricted in their search due to lack of water. Strategies for allowing animals to drink water become important (Peden; ILRI), although simply drilling bore holes (or transporting water in large tankers) and making water available on grazing land can have adverse effects when animals do no longer move and overgraze the land around the water source (Bachmann, Namibia)<sup>6</sup>.

Water used to produce fodder is generally at least 50 times greater than water drunk by livestock (Peden; ILRI). Making the difference between direct (drinking) and indirect (irrigating) use of water with regard to livestock production leads to a key issue: the production of fodder in semi-arid areas under irrigated conditions (Bachmann, general)<sup>7</sup>. This is increasingly practiced by dairy farmers, small-scale as well as medium and large farmers on the Indian sub-continent (Ghotge, India; Uprety, Nepal), but also promoted in small-scale dairy farming schemes in Africa. This practice becomes particularly questionable the moment ground water is used to irrigate the established fodder plots.

### 2.2.3 Expanded mixed crop-livestock farming

Due to the close interactions between crop and livestock production, intensification of crop production also affected livestock production. Where intensified crop production included irrigation, the increased amount of crop residues and crop by-products have been beneficial for livestock production. But if this intensification of cropping was based on the use of ground water for irrigation, it is not correct to blame in the end the animals, although they benefited, for any potential depletion of the water table (Bachmann, general). On the other hand, increased availability of farm yard manure positively affects soil fertility (Savalia, India<sup>8</sup>; Paudel, Nepal, Uprety, Nepal<sup>9</sup>).

---

<sup>6</sup> Drilling bore wells and making water available can also have an adverse effect as seen in Namibia. Water for animals on common pasture land was made available by a development project with the result that farmers did not move anymore with their animals. They stayed around the water sources, and the area was overgrazed in relatively short time.

<sup>7</sup> The bigger issue however concerns irrigation; i.e. water, and in particular ground water used for irrigation. Irrigating food and even cash crops is often accepted, while irrigating fodder plots to produce grass for livestock feeding is less accepted. Are we measuring here with the same stick?

<sup>8</sup> Farm yard manure makes soil more porous and increases recharging of rain water, while chemical fertilizer hardens the soil and reduces the water recharging capacity of the soil. Reducing cattle in such regions means farmers have to use more chemical fertilizers which may lead to reduced water recharging capacity and increased run-off.

<sup>9</sup> If we properly recycle compost and farm yard manure in our field, it will increase the water holding capacity of the soil and reduce the losses of water, i.e. increase water use efficiency. At the same time it will improve soil structure and fertility and it has several positive effects on the life of poor people.

Expansion of crop production in semi-arid areas onto land previously used for livestock production is seen as a threat. This type of crop production makes use of an already rather limited source, water, and as long as it does not integrate the animals it pushes livestock out into more vulnerable areas where they may accelerate the depletion of water sources and in general the degradation of the environment (Savalia, India).

Crop production in unsuitable areas might be even more damaging for the environment than if the same area is used for livestock production (Peden, Ethiopia)<sup>10</sup>. Hence, one has to assess carefully to which extent water depletion and environmental degradation in semi-arid areas is caused by new crops and cropping patterns and to which extent by livestock production.

### 2.3 Livelihood

Right from the beginning, livestock production in arid/semi-arid areas was linked to the livelihood of the households keeping animals (see also 2.1). Furthermore, it was pointed out to the multipurpose role animals in these areas often fulfil (Peden, ILRI). Besides the production of meat and milk, animals provide draft power and manure, with the latter mainly used either as fertilizer or fuel, and their value itself is an asset which can be turned into money in times of needs. It was even pointed out that where livestock are the major asset, water development has to take this into account (Haile, Ethiopia).

Hence, talking only about increased productivity and more intensive production and putting water issues into this context falls short of a comprehensive analysis.

### 2.4 Environmental aspects

Participants were aware about the environmental vulnerability of arid/semi-arid areas, but also noticed that livestock keeping, and other economic activities, are often practised in an unsustainable manner and hence aggravate environmental problems, including the depletion of water resources. Indiscriminate exploitation of natural sources is dominated by the basic principle of economy of demand and supply was one statement (Groeli, general), distributing a scarce resource equitably is rarely a win-win situation was another (Morger, general). Both statements, though a probably right analysis of what presently goes on, carried a tenor of resignation with them.

## 3 Water and Livestock – Preliminary conclusion and 2<sup>nd</sup> round of discussion

The question if participants agree that intensive, industrial livestock/milk production should be kept out of semi-arid and arid areas or completely banned provoked a wide range of replies. Not only the aspect of banning an activity raised concern, but concerns were also voiced with regard to intensive, industrial production.

---

<sup>10</sup> Evidence from Ethiopia also suggests that conversion of grazing land to annual cropland enhances land degradation largely because enhanced run-off on sloping lands carries away soil nutrients and limits the recharge of soil moisture. Thus poorly managed cropland can be less sustainable than well managed grazing lands.

### 3.1 Social and political dimension

Although most CoP participants would subscribe to the idea of keeping water intensive production systems out of arid/semi-arid areas, it is to be noticed that in particular smallholder livestock production in semi-arid areas, even if it gets improved and more intensive, can not be called industrial (Peden, Ethiopia). Hence, such smallholder livestock initiatives should not be measured against water intensive livestock systems (see also 2.1).

Banning water intensive agricultural activities from water scarce areas is not recommended, because the implementation of such a ban is often not feasible (Savalia, India; Haile, Ethiopia). Or because it is political suicide for any government to impose such bans (Morger, general)? Then, as a politician, better do just the opposite and promise farmers free power supply to run their water pumps and get their votes (Celio, IWMI).

It is felt that natural conditions and limited resources may hinder sustainable intensive livestock production in semi-arid areas in the long-run, but only after people have exploited and depleted the resources for a short-term benefit. Hence, appraising the environmental compatibility for any expanded or new activity in a vulnerable environment before taking it up is proposed (Groeli, general).

Another suggestion was the provision of incentives by the government or by the society (consumers?) for more integrated, environment friendly production, including environmental services (Padmakumar, general)<sup>11</sup>.

### 3.2 Resource driven versus demand driven location of livestock production

Livestock production, following economic rules like any other activity, is demand driven with the result that production is not necessarily placed in the ecologically most suitable areas (Ghotge, India); especially not as long as nobody feels responsible for negative environmental externalities and is prepared to bear the consequences (Padmakumar, general).

There is need to ensure that livestock keeping as well as crop production operates within the limits imposed by hydrology and water balances in these arid and semi-arid areas (Peden, ILRI). The appraisal of the environmental compatibility (see 3.1) and subsequent enforcement of the results could help moving livestock as well as crop production back to more suitable, resource-specific locations, since balancing supply and demand is a fundamental principle as far as water management or in fact management of all natural resources is concerned (Morger, general).

### 3.3 Criteria and pre-conditions for “water conscious” livestock keeping

Beside the policy level and the market laws, participants felt that there are key issues at the technical and managerial level of livestock production with regard to an efficient use of water. Three issues were identified and brought up for discussion (Peden, ILRI):

- The source and sustainability of the water used for feed production
- The length of time that animals spend in the arid and semi-arid intensive systems
- The ratio of crop residues and by-products used as feed to the amount of dedicated forage and feed grains used as feed

<sup>11</sup> Yet another intervention is internalising the cost of environmental externalities in the price of livestock products. (6) The environmental services, so far have not captured in our economic models. But now we realised that neglect of the environmental services extracts a heavy price.

### 3.3.1 Source of water

Mentioned already a few times, irrigated fodder production in semi-arid areas using ground water has been identified as a most questionable and definitely unsustainable practice. Examples mentioned came in particular from India and Nepal (Ghotge; Bachmann; Paudel).

On the other hand, rainwater harvesting has been successfully promoted in various project initiatives in Ethiopia be it with pastoralists and agro-pastoralists (Haile) or with small-scale dairy producers (Peden; Biru).

There were further references to the potential of rain and roof water harvesting (Monta, IRHA; Strasser, Helvetas).

### 3.3.2 Grazing intensity in vulnerable areas

While some see %extensive grazing as a major factor for desertification (Biru, Ethiopia)+, there were other voices pointing out at positive environmental aspects from grazing such as reclamation of dry lands, contribution to bio-diversity, etc. (Padmakumar, India).

Interestingly there were several examples (Peden, Ethiopia; Bachmann; Syria<sup>12</sup>; Uprety, Nepal) which showed that a more intensive production where feed and fodder are procured from other sources reduces the pressure on the traditional grazing areas. Grazing time on low productive pastures came down as animals were fed more conserved fodder, crop residues and concentrates.

### 3.3.3 Role of crop residues and crop by-products

While critical aspects of fodder production under irrigation and grazing in vulnerable areas have briefly been addressed in 3.3.1 and 3.3.2 respectively, the positive contribution of crop residues and crop by-products in the feeding of animals in arid/semi-arid areas is mentioned here. As much as using these feed sources is seen as a viable and feasible option in many systems to improve livestock production and production intensity, they may also ease the pressure of livestock in vulnerable areas as well as the need to produce large amounts of fodder crops whereby the environment, including its water sources is depleted.

Examples are cited from Sudan (Peden)<sup>13</sup>, but crop residues and by-products also play an important role on the Indian sub-continent, as well as in West Asia (Bachmann, Syria).

With regard to water, one has to take into account under which conditions the crops are grown whose residues and by-products afterwards are used for feed. Are these crops grown under rainfed condition? Or have they been irrigated with surface water or with ground water? In the latter case, however, one may also put a question mark to the crop production system. Changes in cropping patterns may also result in a loss of feed if the new crops yield less or no longer any residues and by-products for the animals (Savalia, India).

---

<sup>12</sup> Sheep production in Syria is based on grazing the %Badia+, the arid pastures, as well as on grazing harvested crop fields. Today, up to 85% of the fodder comes from crop residues and concentrate, while the traditional grazing areas contribute only about 15%.

<sup>13</sup> In Karthoum, Sudan, the system of livestock fattening works because of the abundance of crop residues and by products that come from both rainfed and irrigated cropping areas nearby.

#### 4 Conclusions and gains

Livestock keeping in arid/semi-arid areas can per se not be blamed for the depletion of the water resources in these areas; livestock can not be held responsible for that (to be exact: one can never make an animal responsible; responsibility always lies with the people).

Questionable practices affecting water sources such as fodder production under irrigation in semi-arid areas, overgrazing in vulnerable areas, non-location specific production and processing (dairying) of livestock produce, intensive or even industrial production, have been identified and put into their social and economic context. While the livelihood link between livestock and livestock keepers was made, there was also an acknowledgement of the strong influence of the market forces.

The insight gained may support the search for recommendations such as:

- Look out for environmentally sound livestock production (environmental compatibility); regarding water for livestock, search for water sources other than ground water
- Improve efficiency of livestock production through a more efficient use of limited natural resources such as water (but also grazing areas) in order not to further deplete water (and grazing) resources, but to save water and perhaps even improve water resources (and pasture land)
- Use crop residues and by-products as feed resources, thereby reducing pressure on grazing land and unsustainable fodder cultivation and increasing the efficiency of mixed crop-livestock farming systems
- Take into account the livelihood of livestock keepers and put traditional and improved animal husbandry practices into the respective context
- Work with incentives rather than bans and exclusions when it comes to a sustainable management of natural resources, including water
- Acknowledge the important overall positive role of livestock in arid/semi-arid areas, despite the current threats from livestock management with regard to natural resource management

### Persons contributing to CoP discussion on “Water and Livestock”

No.	Name	Organisation, Country	E-mail
1	Balz Strasser	Helvetas, Switzerland	balz.strasser@helvetas.org
2	Robert Groeli	LILI, Helvetas, Nepal	robert.groeli@helvetas.org.np
3	Ramesh Savalia	CEE, Ahmedabad, India	ramesh.savalia@ceeindia.org
4	Mitiku Haile	Ethiopia	gualmitiku@yahoo.com
5	Rajendra Uprety	PhD Student, Wageningen, NL	dadomorang@wlink.com.np
6	Nitya Ghotge	ANTHRA, Pune, India	nitya.ghotge@gmail.com
7	Don Peden	ILRI, Addis Ababa, Ethiopia	d.peden@CGIAR.ORG
8	Felix Bachmann	SCA, Switzerland	felix.bachmann@shl.bfh.ch
9	Chhabi Lal Paudel	SSMP, Helvetas, Nepal	chhabi.paudel@helvetas.org.np
10	Chris Morger	Intercooperation, Switzerland	chris.morger@intercooperation.ch
11	V Padmakumar	CALPI, New Delhi, India	padma12312@rediffmail.com
12	Isabelle Providoli	ICIMOD, Kathmandu, Nepal	iprovidoli@icimod.org
13	Mattia Celio	IWMI, Hyderabad, India	m.celio@cgiar.org
14	Vessela Monta	IRHA, Geneva, Switzerland	vessela@irha-h2o.org
15	Assefa Biru	Ethiopia	assefabiru@yahoo.com