Livestock use and degrade much water in the Nile River Basin. New research suggests that integrated development and management of water and livestock resources will conserve water and increase the profitability and environmental sustainability of investments by governments, development agencies, and farmers. This research suggests that through understanding livestock water productivity, practical opportunities to enhance food security, reduce poverty, and foster benefit sharing can be identified. It also suggests that institutions responsible for water resources may benefit from partnering with the livestock sector when developing water resources. This research aims to assist the Nile Basin Initiative to improve the efficiency of water use in the Nile River Basin and to more equitably share the benefits derived from the water of the Nile among its ten member states.

Let’s put livestock use of water in the Nile Basin in context. The Nile River Basin is home to at least 150 million cattle, sheep, and goats, and additionally many more poultry, swine and equines. Animals outnumber humans and consume more food by weight than people. The amount of water used in producing animal feed is 50 times greater than what they drink. The total volume of water used to produce animal feed exceeds that required for production of human food. About 90% of the Nile Basin supports livestock production. In the absence of a financial sector, livestock also serve as a means to accumulate wealth and to insulate against risks. As with crops, poorly adapted, malnourished, and diseased animals have low levels of production, thus using more water for the meat, milk, eggs, hides, manure, and traction power they provide.

Livestock also “use” water indirectly by degrading land and water resources. Inappropriately managed livestock overgraze pastures especially near fresh water sources, causing excessive evaporation, run-off, soil loss, and siltation of lakes, rivers, reservoirs, and ponds. Uncontrolled drinking leads to animals physically entering water bodies that are also important for irrigation and domestic use. Contamination of water with sediments and disease-causing organisms threatens both human and animal health. Trampling and grazing aggravate loss of water quality and destroy riparian and aquatic biodiversity and ecosystem services. Overcoming these constraints is a practical strategy for improving benefits derived from agricultural water in the Nile Basin.

Prior to the research carried out by the Challenge Program on Water and Food (CPWF), and the CGIAR Comprehensive Assessment of Water Management in Agriculture, the prevailing view was that production of one kilogram of beef required about 100,000 liters of water, an amount 20 and 200 times greater than required for production a kilogram of grain and potatoes respectively. However, as part of this research Don Peden and his co-authors have shown that, globally, meat production is more likely to require 50% to 90% less water than previously thought (about 10,000 to 20,000l) to produce a kg of beef. However, in cases where livestock depend on crop residues and byproducts this figure will be even less because, beyond the water depletion attributed to crop production, little or no additional water loss occurs if animal consume the left-over residues and byproducts. There are limits to this strategy, however. Because crop residues have low nutritional quality, there may be need to
provide high quality feed supplements. Nonetheless, it is likely that current levels of animal production could be maintained with less than half of the water depleted under current practices. Within farming systems, at least in the Blue Nile Basin, evidence suggests that Livestock Water Productivity (LWP) is higher than Crop Water Productivity (CWP) for grains and compares favorably with CWP for high value horticultural crops.

New research, carried out under the CPWF, on livestock and water in the Nile region shows that deliberate integration of livestock and agricultural water development activities can potentially enhance the social and economic returns on investments, as well as their environmental sustainability. There are four primary strategies for increasing LWP.

**Animal feed production:** selecting forages and feeds for which crop or plant water productivity is high. In irrigated and rainfed crop production, growing crops that simultaneously produce grains for people and crop residues and by-products for feeding livestock is often more profitable than producing food products or forages alone. These dual purpose “food-feed” crops potentially realize greater benefits from water than single purpose crops. Inclusion of forages in crop rotation may further increase profitability. For example, sale of animal products makes up 35% of farmers’ income in Sudan’s Gezira irrigation scheme. In dry and sloping lands, grazing may be the best agricultural option for utilizing rain water – especially where cultivated fields are vulnerable to erosion and run-off. Here, the opportunity costs for water use are low.

**Adoption of state-of-the-art animal sciences** (genetics, nutrition, husbandry, and veterinary care) and market development. Enhancing the benefits derived from animals through adoption of veterinary services, use of appropriate animal breeds and species, husbandry that minimizes stress that can inhibit feed intake and animal production, and development of markets that generate increased value. Where poor quality crop residues are used for feed, this includes providing small amounts of high quality feed supplements. Very low animal productivity aggravated by high levels of mortality and morbidity means that any water used by livestock results in very little gains for herders and farmers. Integrating livestock and water management can help overcome these constraints. Productive animal use of water can also be enhanced by encouraging value added production by farmers. For example, integrated water resources development might encourage production of butter from milk, and development of market opportunities for livestock keepers.

**Applying grazing and watering practices that help conserve water resources.** Although overgrazing is a major cause of land and water degradation, moderately grazed pasture is one of the best options for controlling runoff and encouraging infiltration and ground water recharge. Limiting grazing pressure to ensure that vegetation covers at least 50% of the ground area is usually sufficient to control runoff and erosion. The most severe overgrazing often occurs in proximity to drinking water sites. Loss of upslope pasture and treking to water leads to destruction of riparian and aquatic habitats, and siltation and lower water quality of reservoirs. In irrigation systems, animals frequently damage canals and degrade water in their efforts to access drinking water. Installation of drinking water troughs and exclusion of animals from open water bodies will facilitate more productive use of water in watersheds and protect irrigation infrastructure.

**Establishing drinking water sites to enable animal production where there are no other agricultural alternatives.** Within the Nile Basin, especially Sudan, vast areas of unterutilized grazing land receive a large fraction of the basin rainfall. Lack of drinking water limits animal access. When animal numbers and grazing pressure are limited to avoid consequent land and water degradation, and irrigation designs include production of alternative feeds, migration corridors, corrals, and access to drinking water it becomes possible to sustainably support the livelihoods of herders and pastoralists. Allocating lands according to “best” use of natural resources including water can help make most effective use of available water and enhance benefit sharing in the basin.

Speaking at the second International Forum on Water and Food in Addis Ababa in November 2008, Carlos Sere, Director General, ILRI, suggested – based on available evidence – that in certain environments, especially where water is physically scarce, livestock keeping is an efficient way to harvest water for agriculture. In economic terms, allocating water to livestock can complement other agricultural and domestic water uses and can give a competitive and enhanced return on investment. Thus livestock can be competitive with other uses of water in some situations but even greater gains in investment returns, environmental sustainability and livelihoods can come through multiple use of water systems. The challenge ahead for the second phase of the CPWF is to re-integrate livestock into analyses of farming systems, agro-ecosystems, watersheds and river basins so that an integrated analysis of water flow through these systems and its concomitant distributions among depletion pathways and among ecosystem processes can be identified. The aim has to be a systematic integration of improved livestock production practices within newly developed and rehabilitated infrastructure and land-use planning involving water resources.

Contact Don Peden, one of authors on whose research this article is based, at the International Livestock Research Institute (d.peden@cgiar.org)

**Livestock water productivity (LWP)** is defined as the scale-dependent ratio of the sum of the net benefits derived from livestock products and services to the amount of water depleted in the process of producing these benefits. This takes into account the importance of water depletion rather than water input because it does not matter how much water is used by a user as long as it can be recycled and re-used without diminishing its quality.

**References**

Peden and Johnson “Managing water through livestock in the Nile Basin”:

Sere et al. “Swimming Upstream: The Water & Livestock Nexus”:
http://www.aid.org/Link/.../swimming upstream livestock%20water%20nexus.pdf

www.waterandfood.org

Peden, Tadesse and Misra “Water and livestock for human development”:

For an overview of the livestock-water issues, see the global synthesis, Water for Food: Water for life. Chapter 13: Water and livestock for human development:

The Collective Action: The CGIAR Challenge Program on Water and Food formed the umbrella under which two CGIAR Centres and the Agricultural Research Corporation (Sudan), Animal Resources Research Corporation (Sudan), Department of Animal Science (Makerere University, Uganda), Ethiopian Institute for Agricultural Research joined hands.