

Sustaining animal-agriculture in a changing landscape—improving lives and livelihoods

Animal production provides one-third of humanity's protein intake and employs 1.3 billion people globally. In Asia, many farming systems are mixed systems, involving links between crops and animals across a variety of environments in small farm systems.

By C. Devendra

This article introduces the animals that play important roles in sustainable agriculture, the diversity of their genetic resources, the types and relevance of their roles, and opportunities for increasing their utilization and contribution.

Asian farming systems are essentially mixed farming systems, involving annual and perennial crops and a variety of animals across a variety of environments in small farms. In these farming systems, animals serve many different functions and for these reasons, the term “animal-agriculture” is widely used.

Agriculture has to keep pace with the food requirements of increasing human populations. Also, with rising incomes, the consumption of meat and dairy products also rises. This has been very vividly reflected in several countries in South East Asia, including Malaysia. Meat consumption *per capita* is now well above 5% per year, and is likely to rise further. A major justification for improved animal production is the need for more animal proteins.

Currently, agriculture is challenged by at least four critical factors: (i) need for increased productivity in food production systems (ii) need to alleviate poverty globally, (iii) need to

improve effective use of finite natural resources, and (iv) need to respond to climate change.

Climate change is the most recent concern, and it directly affects the natural resources, production systems and the environment. Animals are particularly sensitive to heat stress, hence reduction of productivity and longevity due to global warming is likely.

Animals are also involved in very significant environmental degradation. Improved farming systems will need to be innovated and adapted to the changing conditions to ensure the viability of agriculture, not only for food production, but also to allow small farmers to become better stewards of the environment. These objectives may be summarized as follows:

- Develop the capacity of food systems to increase productivity
- Promote agricultural growth that is pro-poor, to reduce poverty
- Promote intensive use of productivity-enhancing technology that is adapted to climate change, and
- Demonstrate efficient natural resource management (NRM), food security and sustainable agriculture.

Table 1. Relative populations and the products from goats and sheep in selected countries in Asia in 2011 (FAO, 2013)

Country	Goats			Sheep			
	Population (x10 ⁶)	Meat (mt)	Milk (mt)	Population (x10 ⁶)	Meat (mt)	Greasy wool (mt)	Milk (mt)
China mainland	142.0	1,887.0	260.0	138.8	2,050.0	393.1	1,529.0
India	157.0	596.6	4,760.0	74.5	293.4	43.0	-
Pakistan	61.5	285.0	759.0	28.1	158.0	42.5	36.0
Bangladesh	53.4	199.0	2,496.0	-	-	-	-
Indonesia	17.5	70.7	281.3	-	-	-	-
Philippines	3.9	54.7	-	-	-	-	-

These objectives require the adoption of new technologies. However, the application and replication of the new technologies is perhaps the most consistently mismanaged and contentious of all activities in agriculture. This observation is borne out of numerous visits that I have made over time to national programs across Asia, Malaysia included. The availability of “new technologies” far exceeds the rate of application. Another common problem is the questionable nature of research, often too narrowly defined, unnecessarily duplicated and of dubious relevance. Also “new technologies” are often not identified with improving the husbandry of animals owned by resource-poor and landless farmers—some 300 million small or landless farmers depend on animals. South Asia, South East and East Asia account for 59–60% of poor livestock keepers in mixed farms. An efficient and dynamic animal sector will greatly benefit the poor. Among the rural poor two thirds are women, and 20–49% of households are headed by women.

Table 1 summarizes the contribution of goats and sheep to the economies of selected Asian countries. Asia alone produced 72.6% of the total global production, and over the period 1985–2012, the volume of contribution increased by 6.8% / year, much higher than the 6.0% for the world production.

Animals are multifunctional and their numerous contributions include the following:

- Diversification in production and use of resources and reduction of socio-economic risks
- Promotion of linkages between system components (land, crops and water)
- Generation of value-added products (e.g. meat, milk, eggs and skins)
- Income generation, investment, insurance and economic security
- Provide draught power for crop cultivation, transportation and haulage

- Contribution to soil fertility through nutrient cycling (dung and urine)
- Contribution to sustainable agriculture, and environmental protection.
- Prestige, social and recreational values, and
- Development of stable farm households.

Animal genetic resources

The animal genetic resources in Asia are quite extensive and include ruminants and non-ruminants. The river buffalo, used mainly for milk production, is very common in South Asia, whereas the swamp buffalo used mainly for ploughing and haulage is more common in South East Asia.

It is estimated that 70 to 90% of the ruminant livestock (buffaloes, cattle, goats and sheep) are found in the rainfed mixed farms, and make a contribution of 25 to 43% of the gross domestic product (GDP) (FAO, 1967–1977). Indigenous animals are fully adapted to the local environments in which they perform and reproduce.

The extent of genetic diversity in the developing countries is reflected in the presence of 97% of the total global population of asses, nearly 100% of buffaloes, 98% of camels, 76% of cattle, 75% of horses, 68% of pigs and 64% of sheep. In addition to the widespread domestic animals, there are other economically important

Table 2. Animal diversity, types of products and their contributions

Species	Products	Contribution
Buffalo	Meat, milk	Human nutrition
Cattle	Meat, milk	Human nutrition
Goats	Meat, milk	Human nutrition
Sheep	Meat, milk	Human nutrition
Chickens	Meat, eggs	Human nutrition
Ducks	Meat, eggs	Human nutrition
Pigs	Meat	Human nutrition
Goats, sheep, camels, yak	Fibre	Wool, hair
All ruminants, camels	Skins	Skins, hides
All ruminants, camels, yak	Traction	Traction, haulage, threshing, packing
All animals	Fertiliser	Dung, urine
All animals	Capital	Wealth and insurance
All ruminants	Conservation	Grazing, ecology
All animals	Sport, recreation	Prestige, pets, fighting, religion, racing, shows
All animals	Horns, bones, fats, tannage	Handicraft

NB. Concerning meats, various offals from animals are also used for human consumption



Swamp buffalo ploughing irrigated land for rice cultivation in Solo, Indonesia

animals of narrower distribution such as camels, donkeys, horses, ostrich, quails and yaks. Camels, donkeys and horses, for example, are greatly valued for use in traction and transport in many parts of the world. Numerous surveys and assessments of the feed resources in Asia have concluded that the opportunities for improved efficiency in feed resource use are enormous.

The following brief descriptions give emphasis to the developing countries where the diversity of breeds is the greatest.

Buffaloes

The current world population of buffaloes is about 158 million. About 96% of this population is found in Asia, in which India has about half of the world's population, with China and

Pakistan coming second and third respectively. The buffaloes of India and Pakistan, as well as those in Europe, Russia, South America and the Caribbean are mostly of the riverine type ($2n = 50$ chromosomes), and are usually large and noted for their milk production. The buffaloes of South East Asia and China are the swamp type ($2n = 48$ chromosomes), and are mainly used for traction, but are increasingly important for meat production as well.

The river buffaloes derive their name from the river valleys which constitute their usual habitat. A number of distinctive dairy breeds are identifiable, the most important of these being the breeds of the Murrah group: the Murrah breed in India, and the Nili Ravi and Kundi breeds in Pakistan. The animals belonging to this group



Indigenous Kedah-Kelantan or Kedah-Thai cattle in Serdang, Malaysia. These animals are used for beef production and traction

are stocky, have short limbs, heavy bones, tightly curled horns, and the skin colour is usually black. They are docile and easily handled. Other dairy breeds are the Surti, Meshana, Jafarabadi and Bhadawari.

Cattle

Approximately 68% of the world population of about 1,337 million cattle are found in the developing countries. 35% of the population are found in Asia, 27% in Latin America and the Caribbean, and 13% in Africa. In terms of breed share, Africa, Asia and Latin America account for 21, 19 and 9% of the total number of breeds respectively.

The cattle fall into three main types. The largest number are humped, either Zebu (*Bos indicus*) found in most parts of the tropics, or the Sanga cattle which are only found in Africa. These humped cattle form the main groups of tropical cattle. The third group is that of humpless cattle in West Africa, Europe and tropical America. There is a fourth group of cattle derived from crossbreeding the Zebu and humpless cattle. In addition, the latter group also includes the crossbreds between *Bos taurus* and *Bos indicus*. Zebu cattle are believed to have entered India from the north, from where they have spread to South East Asia and West Asia. Zebu cattle also penetrated Africa along the trade routes. The Zebu cattle are mainly thoracic humped cattle



South China black goats feeding on rice straw in Nanjing Province, China

and a variety of breeds are identifiable. They are generally dual-purpose cattle, valued for beef and milk, beef and draught or milk and beef. Some examples of major breeds in Asia are as follows: Kankrej, Tharparkar, Haryana, Sahiwal, Red Sindhi, Ongole, Kangayam, Kedah-Kelantan, Sinhala.

Goats

Goats are important animals throughout the developing countries, and are reflected in some 96% of the world population of goats being found here. The population share is 55% in Asia, 19% in Africa and 16% in Europe. Goats were the earliest animal to be domesticated, about 10,000 years ago, next to the dog.

It is generally agreed that the domestic goats are descended from the wild goats, of which there are three types: the bezoar (*Capra aegagrus*) group, the ibex (*Capra ibex*), and the markhor (*Capra falconeri*). Of these, the bezoar is considered to be the main progenitor of the domestic goats, and the contributions from other species are minimal. Domestication occurred in Mesopotamia or West Asia. The species was intimately involved in many aspects of agriculture in the early civilization of the societies in this area. It is from here that the dispersion of goats took place westwards to Europe and sub-Saharan Africa. In Asia, the dispersal of goats occurred through trade routes from West Asia, and is considered to have occurred along two routes.



Woman delivering cow manure to fertilise rainfed crop land in Song Be Province, Vietnam

One route was from Iran, Afghanistan and Turkistan to Mongolia and northern China along the “silk road”. The second route was via the Indian sub-continent through the Khyber Pass.

The developing countries together account for 64% of the total availability of breeds, made up of 26% in Asia, 16% in Africa, 16% in East Europe, and 6% in Latin America. Within Asia, the largest populations are found in India (35.2%), China (29.3%) and Pakistan (12.0%). These countries together account for about 84% of the population of goats in Asia. Some examples of the more outstanding breeds in Asia are as follows: Barbari, Beetal, Black Bengal, Damani, Jamnapari, Kamori, Malabar, Katjang, Ma`tou.

Sheep

The sheep population in the developing countries is quite sizeable, and account for about 64% of the total world population of about 1,607 million sheep. Within this, the population share across region is as follows: 39% in Asia, 23% in Europe, 12% in Africa and 8% in Latin America (Table 2). Within Asia, the largest populations are found in China (43.7%), India (17.8%) and Pakistan (11.0%). China, India and Pakistan together account for about 72% of the total population of sheep in Asia.

Sheep were domesticated close to the time when goats were domesticated. The main ancestor of domestic sheep is considered to have been the urial of South West Asia, In terms of breed

share, Asia has 18%, Europe 15 %, Africa 11% and Latin America only 3%. The more important examples of sheep breeds in the various regions are as follows:

Asia: Rakshani, Kaghani, Lohi, Damani, Kajli, Bellary, Mandya, Baruwal, Javanese Thin-tailed, Chokla, Pugal, Han, Tan.

Latin America: Barbados Blackbelly, Virgin Island White, Pelibuey, Moroda Nova.

Pigs

Of the total world population of about 914 million pigs, 68% are found in developing countries. Of this population, 37% are found in Asia, as also 37% of the total number of breeds. It is now known that the domestic pigs (*Sus domesticus*) is descended from the wild boar (*Sus scrofa*), which is essentially a forest animal. The wild boar is believed to have given rise to several different varieties of pigs. Thus for example, *Sus scrofa moupinensis* has greatly influenced the origin of native pigs in the central region from Hubei province in the north to the Sichuan province in the south. Domestication in West Asia appears to have taken place in the wetter highlands that surround the Arabic, Syrian and Iranian deserts.

Some examples of indigenous breeds in Asia (China) are: South China Black, Ba Xuyen, Beijing Black, Jilin Black, Jianli, Kwai, Min, Meishan, Xinjin.

Chickens and Ducks

Chickens and ducks are also important components of the animal genetic resources especially in the rural areas of the developing

countries. Both species are fully adapted to the rural environments and make a most useful contribution to the family nutrition, food security, income and stability of rural households. They are usually scavengers in and around the rural households where they are reared, living on kitchen remnants, crop residues, worms and waste foods. Native chicken are mainly meat producers and also provide some eggs. The meat is considered by the rural folk to be more tasty than that of broilers (chickens specially bred and raised industrially for meat production), and probably for this reason, the birds fetch a relatively higher price in the market.

Ducks produce meat and also eggs, and usually thrive in areas where there is water such as ponds, streams, rivers and rice fields. In such situations involving ponds and waterways, ducks along with native chickens and pigs constitute important components of integrated systems involving annual crops as well as kitchen wastes. Such systems are common throughout East Asia and South East Asia.

Given the awesome reality that the current supplies of animal proteins are totally inadequate for current and projected human requirements, assertive priorities and development pathways need to be defined that can increase meat and milk supplies from ruminants. There is much to do, remembering that agricultural research

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is one of the most economically productive investments that a government can make. The resultant direct benefits are improvements in the

livelihoods of the poor, reduced poverty and an agricultural landscape that is blessed with peace and abundance.

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