Editorial Introduction
The Role of Livestock in Community Development

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Introduction

In many countries animals far outnumber people. Sheep in New Zealand, for example, outnumber people by a ratio of 3 to 1. There are 2.2 animals per person in Sub-Saharan Africa. The average developing country village and even some urban slum areas are characterised by a variety of small and large animals which scurry, peck, forage and plod their way through most aspects of community life. An understanding of the multi-faceted role played by such animals in the lifestyle and economies of human communities is of fundamental importance to those involved in development activities.

This issue of the CDJ continues the trend of previous special issues in examining the impact and importance of specific social and economic areas as they relate to community development. One such area is livestock production. The conceptual framework used for this is constructed around three main areas of enquiry:

Understanding and classifying existing livestock systems, with particular reference to the small-scale, low technology "backyard" or "homestead" production systems as found on many family holdings throughout the world.

Looking at methods for making existing systems more productive, such as the different categories of "inputs" necessary to livestock production like fodder, water, shelter, veterinary/animal health, human labour and husbandry methods and how these can be improved in socially acceptable ways compatible with existing community lifestyles and the health and well-being of the livestock.

Introducing new livestock production systems, or making significant alterations in existing ones. Examples include using animal power in novel ways in agriculture, milking goats for the first time, or (in the past), displacement of human communities to make way for the introduction of livestock such as sheep. The issue examines the "outputs", (or livestock products which benefit communities) and the "inputs" which are necessary by communities for effective livestock production.

Origins and Scope of Domestic Livestock

Early humans generally hunted wild animals to supplement their diet, or provide skins for clothing and shelter. Such methods of gathering and hunting for food did not make it possible to support many people per unit of land. The need to increase food production stemmed from the increased density of population associated with settlement. Gradually humans learnt to domesticate some animal

species. For example, the raw materials for such traditional rural industries as tanning, candle-making and the wool industry for centuries in medieval Europe were provided by livestock. Also, until fairly recently, food-producing animals were still kept in the centre of towns in Europe. Today this is rare. However, in parts of Dublin, Ireland, horses are kept in suburban gardens and taken daily to feed on the grass verges of the roadside. Sheep are also found in some apartments in Naples, Italy, and taken out daily to find food. In the developing world, livestock are found frequently in urban areas of Africa, Asia and Latin America. In some places there are a few cattle and some sheep or goats which are daily driven to pasture and brought back in the evening. In other places food animals are driven from an urban area to a seasonal pasture where they remain under the supervision of a herdsman. With the growth of urbanisation in both the developed and developing world the patterns of human and livestock interaction changed radically. In towns, wages became generally associated with the means to acquire food rather than cropping and rearing animals. Now the dichotomy between urban communities and livestock has reached a stage where young urban children, particularly in developed countries, may never have seen a cow and even presume that milk and other dairy products originate in cartons or bottles and have no animal connections. In this issue Lin Whitfield’s article outlines new ventures in re-introducing livestock to urban communities in Britain through the growth of “city farms”.

The scale and nature of domestic livestock production appears to be relatively well documented for developed countries, but is often less clear-cut in developing countries where livestock numbers can often only be roughly estimated. The number of animals may fluctuate rapidly seasonally or with changing production conditions such as price variations, drought or disease. Nevertheless, some general figures are available which indicate that in 1983 developing countries (containing 75% of the global human population and 58% of all agricultural land) also contained 68% of the world’s cattle and buffaloes, 65% of its sheep and goats and 58% of its pigs. Global statistics do not reveal the exact distribution and ownership of this livestock, but much of it is owned by the poorer peoples of the world. In Peru, with a human population of about 16 million, there were said in 1986 to be 2.4 million llamas and half as many alpacas. All of the former and four fifths of the latter belonged to small farmers living in peasant communities. However, the very poorest sections of many communities may be recognised as not having any livestock at all.

Livestock production systems in the developing world tend to be far less capital intensive than in the developed world. They generally involve few permanent buildings and little equipment, so that producers go in and out of production more often, thus changing livestock production scales. Finally, many of the larger domestic animals are kept under nomadic or semi-nomadic forms of husbandry so that not only numbers but the locations of production shifts.

Livestock provide or contribute to the livelihood of millions of people throughout the world whether farmers, landless labourers or nomadic pastoralists. Figure 1 illustrates some of the main roles played by domestic livestock in relation to human communities.

A measure of wealth

A whole way of life

Source of extra cash income

Help on the farm

Transport

Provider of food and household articles

Special responsibility for some family members

Companion and guide

Figure 1. The Many Roles of Livestock in Families and Communities

The major livestock products or outputs can be divided into 10 main categories (see Figure 2). Income from livestock includes not only cash sales of animals, but also sale of services such as ploughing, manure and transport. In addition, livestock act as a store of wealth and an investment. Land improvement and agricultural improvement includes animal traction for ploughing, animal power for pumping water and post-harvest processing, the use of manure for fuel and the making of fertilizer from faeces, bone, feather or horn. Tools such as leather harness or bone implements are often made from animal products.

Food is an obvious livestock output, whether directly from meat, fish, milk, eggs, honey or blood, or via help with hunting, herding (e.g. dogs) or transportation of agricultural products and other food (e.g. donkeys and cattle). Livestock products which are used as clothing include wool, skins, hides, leather, feathers, fur and silk. Animals in some countries provide warmth during the winter since cattle and other livestock in an adjoining stable help to heat the farm dwelling. Shelter for humans and animals may contain livestock by-products, such as manure and mud floors and walls. Skins may be used as tents. Security may also be provided by dogs or geese which guard the homestead.

Livestock also provide companionship for humans, such as for the elderly, young or the lonely, particularly in urban environments. For many owners the loss of a close pet can trigger a serious emotional crisis whose impact is similar to the loss of a family member. Animals have also been used for therapeutic purposes with the mentally and physically disabled, such as in horse-riding. In developing rural areas young livestock such as puppies, kittens and chicks serve as companions and a source of entertainment where there are few “toys” available.

The positive hygiene and health aspects of livestock output include soap making from animal products, transportation of water and the garbage-scavenging activities of pigs. The negative health aspects are those diseases which can be transmitted from animals to people and are called “zoonoses”.

Ceremonial events in many societies include the use of livestock. They may be consumed to mark special occasions such as the turkeys of Christian festivals or the rams of Islamic ones. Livestock may also represent wealth and status, such as in the ceremonial pig exchanges in Papua New Guinea. They may also be used in dowry exchanges such as sheep, cattle, goats and camels in African countries.

**The Role of Livestock in Economies**

Livestock play an economic role at national, community and individual levels. The economies of some countries are very much dependant on livestock, such as the pastoral production systems of Sudan (with 2.9 million camels) the extensive ranching systems of Argentina or the dairy cattle production system of Holland.

Ecological changes have had profound effects on livestock numbers and on national economies. Before the recent drought, Sudan with a human population...
of approximately 21 million7 was estimated to have 20 million cattle, a similar number of sheep and 13 million goats, sufficient to supply each person in Sudan with 20 kg. of meat per year. However, despite the effects of drought, Sudan still exports some meat and considerable numbers of livestock, from which it earns about 75 million U.S. dollars per year.8

Livestock also represents the major source of income and the most significant — if not the only capital asset for the vast majority of poor people who live in the drier regions of the world. In more arid lands nomadic pastoralism is the only way to make use of the land that would otherwise be quickly degraded to barren desert by settled agriculture.3 Small homestead livestock are characterised by low per capita maintenance requirements compared with cattle, horses or water buffaloes, faster reproductive cycle and easier marketability, given its small size and value.9 Sheep, goats, chickens and pigs are able to scavenge for food so that they usually require less herding and supervision.

The role of the livestock sector as a source of employment is not easily determined in those areas where much production is consumed at home in areas where there is underemployment, or where women and children tend the stock. Much of the work required for livestock-keeping on family farms can be performed by women or children, or shared between households where there is communal herding, and the tasks are often regular rather than seasonal.4 In nomadic pastoral societies the needs of livestock determine the location and movement of whole population groups as they and their animals seek water and pasture in an interdependent survival pattern.

At community level livestock may constitute a major occupation, or a vital input into another activity such as farming or hunting. Livestock may also be a useful, low-cost method of supplementing income, such as in village sheep and goat rearing. In many developing world communities livestock ownership is equated with wealth and status. Livestock also represents an insurance policy against hard times — a store of wealth which can be converted to cash, or exchanged when a small income is desperately needed to survive. It can be an asset to be exchanged or consumed for a special celebration. This is why livestock has developed such deep cultural and religious significance in many societies throughout the world.3 For poor livestock farmers and households with a single cow or buffalo, the injury, death or infertility of the animal can be an economic catastrophe. So also can be its lowered production of milk or inability to work. A draught animal for example, which dies in the first few months of adoption, may still have to be paid for over several years — even if it contributed nothing to the farming family's income. Thus access to simple medicines and training in improved husbandry techniques can enable poor farmers to increase their income and retain control of their enterprise.10 Where they have been introduced at small farm level, livestock insurance schemes have proved very valuable.

Livestock Production Systems and Communities

Livestock as Source of Community Power and Fuel

In developing countries animal draught power represents a major output from

7. UN World Population Chart, UN, N.Y., 1985.
the livestock sector, although it is one that is often underestimated or ignored. In fact, about half the labour these countries use for agriculture is said to be contributed by livestock. Specifically, animals provide 23% and 9% of the use of power for agricultural production in Asia and Africa respectively. In this respect they are more important than tractors. In Latin America and the Near East animals still provide about one-sixth of agricultural power, though tractor use has increased rapidly in the past decade. In the Philippines and a number of other South-East Asian countries a ban was imposed on the slaughter of buffaloes to prevent the continuing depletion of draught animal power. Buffalo are vital to the rice economy of South-East Asia, where the very restrictive pasture that is available is allocated almost exclusively to draught animals and rearing their replacements. India has about as many cattle and buffaloes as Europe and the USSR combined.

Four million draught animals in developing countries directly or indirectly serve two billion people. Animals include cattle, buffaloes, horses, donkeys, mules, camels and yaks, which are used to cultivate up to half of the total area cropped in developing countries. They also pull 25 million carts. Ploughing accounts for 90% of animal power usage in primary cultivation. Animals are used in post-harvest processing such as in threshing grain, grinding oil seeds and crushing sugar cane. They also provide power for irrigation. However, to the livestock owners manure may be a source of cash rather than being used by the household. Dried animal faeces are important fuel sources in Africa and Asia. For example, in India, 60-80 million tons are estimated to be used in this way annually. A number of countries have also used ruminant and pig faeces to produce methane as a source of energy.

Livestock and Human Nutrition

Some livestock can process forage (from grassland and scrub areas) and waste crop materials (like crop residues — straw, cane and corn husks — which are inedible by humans) into nutritionally desirable human food products, many of which have a high protein, mineral and vitamin content and including some of high calorific value. Approximately 40% of the total land available in developing countries can be used for some form of forage production and a further 30% is classified as forest with some potential for the production of forage. In addition, some 12% of the world's total population live in areas where food crops cannot be easily grown and where people depend entirely on the products obtained from ruminant livestock. Many species ultimately killed for food have a primary role as draught animals or as producers of milk, wool and fuel.

Livestock can be productive and provide an income while being fed largely on agricultural waste or by-products without competing for human food or scarce land resources. Poultry can be fed on banana waste, fish silage or shrimp waste. Cattle gain important nutritional complements from the by-products of cotton and groundnut growing, brewing, etc. However, it is also reported that over 60% of all grain consumed in developed countries is fed to animals. The proportion in developing countries is only 13%.

In 1980 world production of meat, milk and eggs for human consumption, together with fish, provided 33% of the global average daily intake of foodstuffs as well as 17% of the total intake of calories. In places where little animal protein is consumed the nutritional situation in the lowest income groups is often precarious because they cannot afford enough or the right kinds of vegetable sources of protein to fill the dietary gap. Gurney's article also points out that in many countries, iron deficiency anaemia is caused not so much because people don't eat enough foods containing iron, but because it is poorly absorbed. Iron absorption is enhanced by the presence of small amounts of meat in the diet. This is an important nutritional value of livestock.

As families drift into the slum areas of developing countries in search of work, their low wages often fail to provide an adequate family diet, particularly for children. Diets generally deficient in animal products have to compensate with a greater variety and quality of plant protein foods. This compensation may be difficult. Where animal foods are in short supply small children in particular have a problem in obtaining sufficient plant protein for their growth needs. At community level, nutritional needs may also take second place to financial needs. For example, poultry may be raised for the sale and not the home consumption of eggs.

A high percentage of animals bred for human consumption are exposed to drugs, including tranquilizers and hormones acting as growth stimulants — to prevent or cure disease, but also to promote commercially desirable growth. It was estimated in 1985 that half of the beef animals in the United Kingdom and more than 90% of the cattle in the U.S.A. are treated with growth promoters. The residues of such drugs may find their way into food and can therefore pose a risk to human health. As agricultural production is increasingly becoming an industrial operation all over the world, the use of drugs in animal husbandry will continue to

rise, thereby increasing the need for establishing universal standards. The Codex Alimentarius Commission has been set up by the World Health Organisation and Food and Agriculture Organisation to provide an inter-government forum on food standards and to establish a Committee on Residues of Veterinary Drugs in Food. Some countries have prohibited the use of growth promoters, but in others there are suspicions that the practice continues. The incorporation of antibiotics in animal feeds can also lead to antibiotic resistance in human populations.

It has been said that to produce food totally free from residues must, however, be considered a practical impossibility. It could only be attained by abandoning the use of therapeutic agents altogether.

This is clearly an unacceptable option in contemporary veterinary medicine and in modern agriculture. There is said to be sufficient existing information to take practical steps to protect consumers against harm from residues, e.g. by establishing a lapse of time between treatment and slaughter or milking. However, others contend that little research is being carried out to explore alternatives to the feed additives. There is also unwillingness to look back at traditional animal-rearing practices which did not depend on such inputs.

A main problem regarding food safety in many developing countries is in putting existing legislation into effect. This is particularly true of milk and meat products, large quantities of which still escape examination and pasteurisation. The sale of milk and meat products is, in principle, subject to inspection by veterinary authorities. In practice this inspection is confined to the towns. Refrigeration facilities for storing, handling and carrying meat are scarce and facilities for bacteriological examination of meat and other food products. In addition new hazards are emerging. The recent Chernobyl disaster for example, had far-reaching implications. In the Philippines the Ministry of Health has banned several batches of milk powder from Europe (mainly Switzerland and the Netherlands) when they found the level of caesium to be unacceptable in the milk shipments.

Inputs into Livestock Production Systems

Satisfying Basic Livestock Requirements

Animals need food, water, health care and shelter for living or sleeping. Some also need protection from accident, predators or theft. Animals may thus compete with people for community resources. Where resources are limited both humans and animals suffer, such as in the case of scarce water supplies. Water supply is a primary consideration when introducing or extending any form of livestock production. Good water supplies which are not infested by pathogenic, (disease-causing) micro-organisms are needed. Milk producing animals have the greatest need. There is also a serious danger of over-grazing close to watering points unless the need for balance is properly understood and close control is kept over animals and their numbers. When developing a water supply for livestock the number of wells has to be related to the availability of feed in the same area. The investment in water must also be adequately matched by investment in measures to control insects and infectious diseases, which are intensified by a concentration of animals. Improved productivity of the animals may also raise problems of use or marketing. Plans and provisions for this must be made, which in turn, may require changes in the attitudes of the owners.

Other categories of inputs to livestock production systems include fodder, the use of household waste, agricultural by-products, hay-making and fodder crops. Fencing is also often a costly input and therefore a major step in the transition from low-cost to more intensive and expensive forms of production.

There may be upgrading from family to community ownership of livestock, such as cooperatives, joint ownership, communal village herds, etc. Conflicts have arisen between groups involved in activities such as herding and crop farming, where these based on differing membership. Eventual resolution of such conflicts is determined by the balance of power in different societies.

The Roles of Women and Children in Livestock Production

In many developing societies caring for small ruminants such as goats and chickens is predominantly the work of women and children. Even where the management and care of animals is largely men’s work, women may be responsible for milking and processing milk, collecting fodder, drying cow-dung for fuel, caring for the lactating, young or sick animals. Women and children usually care for introduced non-traditional small animal species such as rabbits, guinea pigs and milk goats.

SURVEY OF CHILD ACTIVITIES: JAVA

By the age of 10-12 boys and girls are net producers, by 15 years boys may have compensated for their cumulative consumption.

(Pop. & Develop. Rev. Sept '77)

Figure 4 The Growing Child Cares for Community Livestock.

Credit: Tropical Child Health Unit, Institute of Child Health, London.

For women and children livestock production also has to be integrated with a wide range of other responsibilities such as caring for the young and the elderly.

Development projects have often been more concerned with demonstrating new husbandry techniques to interested individuals than improving and adapting the techniques and social organisation of labour that already exists in the community. There have also been a number of occasions when project directors and planners realised that project effectiveness was being undermined by the fact
that the main effort was being aimed at male heads of households—while much of the animal production work was being performed by women. In contrast, a Kenyan smallholder dairy production programme where direct on-the-farm sale of milk to neighbours was generally handled by women (who also participated in or were responsible for the management of the cows), the growth in small-scale dairying was assumed to have strengthened the economic power of the women. In West African Fulani cattle-herding communities, women normally do the milking and keep the proceeds of sales. They may even own certain cattle and keep their offspring.

In many developing countries the need has been demonstrated for female community workers to provide links between the village women and agricultural extension officers who are invariably male. During a poultry vaccinating project in Pakistan, for example, it was found culturally inappropriate for male veterinarians to visit women to vaccinate their chickens when their husbands were absent. The realisation that the unvaccinated birds were a potential source of infection for the whole village led to extensive training of female extension workers. In the Yemen Arab Republic a female extension expert and ten local women were employed as extension agents in highland areas. In addition to teaching improved farming and small livestock rearing techniques they were also involved in literacy work (present female literacy rate is 20%) and broader advice concerning health and nutrition.

Animal Health, Livestock Productivity and Human Health

FAO estimates at least 5% of cattle, 10% of sheep and goats and 15% of pigs in the world die annually due to disease. According to another FAO estimate, animal diseases contribute significantly to the loss of over 30 million tons of milk annually, enough to provide almost 200 million children with two glasses of milk a day.

Zoonoses Affecting Livestock and Communities

Over 150 diseases which affect animals also affect man. These "Zoonoses"—human diseases with animal sources—are transmitted to people through animal bites, direct or indirect contact with living or dead animals and animal products like meat, milk, eggs, wool or hides, and also those who eat foods from animal sources, particularly foods subjected to careless preparation or inadequate cooking.

The persons most vulnerable to these numerous zoonoses are farm families and other people closely associated with agricultural occupations. Not only is the health of human food producers affected, but also the animals themselves are unable to produce meat and dairy products or to work. In addition, zoonoses affect draught and transport animals upon which plant agriculture in much of the world depends so heavily. Zoonoses cause impaired productivity among livestock, acute or debilitating illness among humans, and consequent effects on the social

structure and economic development of developing countries, particularly in the Americas and in Africa. In 1978 for example it was estimated that 1.3 million calves died annually from “brucellosis” with an economic loss to Argentina of approximately 155 million U.S. dollars.

Man-made changes in the landscape or the ecology may introduce or abruptly increase the danger of human infections from animal reservoirs such as in the case of rats and plague. Diseases resulting in much sickness and death have been reported from irrigation projects, artificial lakes, areas of deforestation and railway and road construction sites. Changes in land use can also cause problems as for example where deforestation in South America to create cattle breeding pastures introduced vampire bats and through them, rabies. A better understanding of ecological relationships could be used to control diseases. One of the recent WHO Technical Reports on malaria points out that by keeping livestock at a certain distance away from the houses, mosquitoes can be deflected away from the human population, i.e. the animals get bitten, rather than the people. The risks of malaria are therefore said to be reduced. Similarly where pigs are kept by villagers it is often found that the tsetse fly, vector of sleeping sickness, prefers to bite animals rather than humans.

In recent years more attention has been paid to risks posed by zoonoses. This partly reflects greatly expanded international and natural trade in live animals, animal products and animal feedstuffs which facilitates the spread of infection. Other causes include poor housing, limited water supplies, lack of adequate food storage methods, or waste disposal, especially in the expanding urban areas which may also be infested with rats. Bogel’s article outlines existing resources which can be mobilised and practical steps which can be taken by families and communities to prevent zoonoses.

Organised government veterinary services which attempted to control zoonoses emerged less than 100 years ago. Trained Animal Health Assistants (AHA) were an integral part of the veterinary service in Colonial territories in Africa, India and the Far East. Most developing countries now have training centres for AHAs geared to their own special requirements. More recently, regional centres have developed, serving a number of countries. A pattern similar to that evolved by the British Colonial system was used in the French, Portuguese and Belgian territories in Africa. AHAs are required to have ten years of schooling plus some experience of basic science subjects in order to qualify for the two year course. Where new aspects of agriculture are developing in the country, good AHAs with field experience can be selected for further training in animal husbandry, animal production, dairying, range management, etc.

It would not generally have been possible to provide veterinary services without massive use of AHAs and even today with the increased number of veterinarians the demand for AHAs appears to be increasing. However, the situation is complex because of differences of outlook between veterinarians and animal scientists, each with their own interests to protect, and both feeling “uneasy” about the idea of additional competition from animal health auxiliaries.

Mobilising Veterinary Services for Community Development

The potential for mobilising veterinarians and veterinary students for community development remains largely unexplored. There is a need to reorient veterinary education in line with the needs of the largely rural population. Tan in his article in this issue points out that while student veterinarians may have been

exposed to such high-tech wonders as embryo transfer, they may be unfamiliar with problems of the average peasant farmer's water buffalo. In addition, existing approaches and patterns in extension work tend towards piecemeal "hit and run" approaches which, in the long run, be unproductive in terms of community development, as they perpetuate dependence on outside experts—whether students or professionals—institutionalizing an "elitist" relationship between information providers and information recipients rather than a partnership oriented towards economic and social change.

No longer viewed as an "animal doctor", community-based veterinarians find themselves assuming multiple roles. In agri-nutrition programmes, the veterinarian helps to improve the effectiveness and practicality of nutrition education, as communities enter into livestock production schemes.

In some countries community members have received basic training to enable them to provide "front line" first aid services for animals (such as the rural Indian women described in Rutherford's article). The idea of "para-vets" or "barefoot vets" has not always been well received. Some such initiatives have failed where trainees were school leavers with low standing in their own communities, or received inadequate training. This concept appears to work best when existing livestock owners who are already respected in the community have their skills and knowledge upgraded so that they can provide not only a basic service to other livestock holders, but can also train them in turn to use improved animal husbandry techniques. Nomadic scouts have been appointed and paid for by village communities in Ethiopia, Madagascar and Niger to provide low cost animal health services.

Improving Traditional Systems and Introducing New Production Methods

Traditional Livestock Production Systems and their Evolution

The least extensive systems can be described as forms of grazing which include ranching, nomadic systems and transhumant systems where pastoralists migrate seasonally from a fixed base. The livestock involved are camels, cattle, sheep, goats, llama and alpaca. In nomadic and transhumant systems, communities keep as many animals as is consistent with the availability of forage and water. Overgrazing is common, as land is communally owned. Livestock are individually owned and female livestock are often the only available outlet for investment. As less land becomes available for grazing (more is used for settlement), as veterinary services and water supplies improve, and refugees and their animals are displaced into areas which cannot support them—the overgrazing problem worsens. In development terms communities may change from nomadism to transhumance so that advantage can be taken of medical, educational and other social facilities. In addition attempts may be made to restrict the size of the human population dependent on the system, improve livestock productivity by better management, feeding and veterinary attention, reduce total livestock numbers and possibly to change the animal system to one which sells young stock out of the area to be reared or fattened elsewhere. Shifting Cultivators usually raise only small stock such as goats, sheep and poultry. A change to sedentary cultivation requires not only crop rotation, but also a much higher labour input and can be assisted by introducing work animals (which may also supply food and fertilizer or fuel). The problems encountered include pest and disease, inadequate capital, lack of understanding of animal husbandry or the maintenance of traditional attitudes which are inappropriate in a changing situation. In some cases sheep and/or goats,
if not already raised, can be introduced. Sedentary Systems of agriculture are the norm in regions of dense rural population. The use of working cattle and/or buffaloes is widespread. In drier areas most farmers keep a few sheep or goats and some fowl. In wetter areas the rearing of pigs and ducks is common. Integrated systems with rice, fish and ducks or with pigs, fish and vegetables are also viable in such areas.\textsuperscript{13}

Integrated farming systems involving livestock, fish and poultry have existed in China for a long time. In other Asian countries there are similar systems of long tradition in popular use. Interest in, and experimental work on them, is rapidly gaining momentum. These systems use waste products from one sub-system as inputs in another and provide attractive alternatives to reliance on food production systems which need high inputs of fossil fuel. China, for example, produces over 800 thousand tons of fish annually from ponds receiving organic matter such as waste, animal manure, rice bran, brewer’s waste and various materials gathered in the vicinity of ponds including grass and snails.\textsuperscript{23} In future the recycling of organic wastes in this manner through fish may provide one of the cheapest sources of food of animal origin in tropical countries as well as a profitable way of overcoming the increasing problem of waste disposal in crowded cities.\textsuperscript{24}

Different systems of integrated aquaculture are evolving for different purposes. For example, a system of cooperation has developed in the vicinity of Bangkok in Thailand. Small landowners with fishponds of about one hectare permit landless countrymen to build a home and pig pens over their ponds. The pig farmer buys restaurant swill and some concentrates plus rice bran and broken rice. These are mixed with water hyacinth and fed to the pigs. The pig manure and feed waster fall into the pond and provide additional nutrients for the fish. The system also relies on cooperation between the landowner and the pig farmer because the annual fish harvest is a joint effort. In addition, after the pond is drained, the bottom is dredged and the “compost” used for fertilizing crops. Related systems are found elsewhere in south-east Asia and involve chickens and ducks.\textsuperscript{4} Brown and Prayitno describe in their article a type of integrated aquaculture in Java, Indonesia, where rabbit hutches are kept over village ponds and where even water supply channels are utilised for fish culture. In Mixed Farming in the wetter tropics, animal production can be combined with tree-crop production such as where ruminant livestock graze under coconut palms. Such systems can also be practiced in fruit, rubber and palm-oil plantations. Alternatively, the fodder is cut and carried to the livestock.\textsuperscript{13}

With the migration of large numbers of rural people to the areas surrounding large cities, opportunities are needed for them to improve their diet by raising small animals such as poultry, rabbits and guinea pigs, fed on waste food and garden forage. In less densely populated areas small numbers of sheep, goats, pigs or poultry are often kept and left to scavenge around the houses. This scavenging function and the relationships between livestock and usual household livelihood are outlined in Best’s article on Sarawak. The characteristics of an ecologically balanced agricultural system involving livestock are depicted in Kiley-Worthington’s article on an experimental farm on a Scottish island.


Some Implications of Changing Systems

While the introduction of animal power can raise living standards and decrease drudgery, Starkey's article reveals that it also causes changes within village economies and traditional agricultural patterns. For example, in the Gambia within a single generation there have been two agricultural revolutions. The first related to introduction of work oxen from which followed the second which was the farmers' own initiative to switch to donkeys. These have changed farming systems and influenced almost all members of the rural communities. Before promoting animal power innovations the social and economic repercussions for community members must be considered. For example, using animal traction to increase cultivated areas can also increase the labour of weeders and harvesters — who are often women. The article also recounts how farmers in Malawi who had initially bought animals for ploughing found it more profitable to use their farm animals for transporting goods and then use part of these profits to hire labourers to hand plough their farms. Also, where draught animals are used for water raising from wells or for crop irrigation, agreed community systems have to be devised for sharing animal power use and costs. The hiring out of livestock can also be a major source of income for landless people. Once draught animals have been adopted within communities they often acquire important social values in addition to their technical and economic benefits. It is commonly observed throughout the world that work animals may be considered almost as part of the family and they may be retained even after the costs of maintaining them have become far greater than their economic usefulness.

Realistic Project Design for Equitable Development

More and more Community Development programmes are recognising the importance of incorporating livestock components into their development initiatives to provide extra income. Domestic needs should generally be met first before production for commercial purposes. Price fluctuations and marketing difficulties mean that so many income-generating projects involving livestock do not succeed. In designing projects plans must include methods for processing livestock products and by-products and marketing. As in crop production, absence of village-to-market roads presents problems in transporting livestock to be sold. In the North of the Philippines, farmers are reported to walk as far as 40 kilometres herding the livestock they want to sell at the nearest town centre. Purchasing draught animals may also involve the same kind of travelling.

It takes time to design and implement appropriate livestock projects where a whole farming system is involved and in a way which promotes more equitable rural development. The agents of change need to work in the real economy of the livestock holders and modify their ideas as to what is achievable, sustainable and transferable within that economy. A major attraction for improving the productivity of smallholder animal production is that improvements in this area can provide year-round employment for families who currently only have seasonal employment — if any. Priority, however, is not always given by the livestock owner to obtaining a high rate of output of food products from his stock because other products and services derived from them may be more important in his system. Improvement in the output of livestock products from small farms usually cannot take place without simultaneous improvement of water resources and/or feed supplies. Yet such changes may depend on agencies or programmes whose mandates or goals may have limited involvement with livestock production.

Major mistakes are still being made (as Best's article points out), in attempting to improve the breeding of livestock by the importation of exotic animals. Such
measures should only be advocated after intensive investigation shows that it would be advantageous, that animal health measures are satisfactory and that the quantity and nutritional quality of food available will be adequate.  

Realistic and effective project designs will require better coordination between the various development sectors or there will continue to be duplication and overlap of efforts, missed opportunities for resource-sharing (like transport or buildings), and lack of reinforcement of each other's efforts, especially in remote areas. A community often finds itself the "target" of different development sectors. In the eyes of communities themselves their own existence is "integrated" and not labelled "education", "agriculture", "livestock", "health", etc., for the convenience of development sectors and agencies. The results of such uncoordinated action at community level are fragmented development efforts, which in turn can cause fragmentation of communities themselves. For example, one sector encourages the production of eggs for sale, while another encourages families to consume their own eggs for nutritional purposes. The results of uncoordinated action are also felt keenly at the level of the fieldworkers of the different sectors who deal directly with communities. Also, their own positions in the hierarchical sectoral systems are usually junior, thus providing them with few opportunities to report on their experiences in this respect.

**Major Challenges for Livestock Production and C.D.**

One of the challenges facing us is how to increase and improve livestock outputs without upsetting the ecological balances between animal and environment, humans and animals and humans and their surroundings. Without such balances there is overpopulation by animals, over-grazing, insufficient food for animals and humans, weak or distressed animals, increase in zoonoses and insufficient space and time for people to enjoy the benefit of the livestock with which they share the earth.

**Reviews and Information Section**

In keeping with the action-oriented approach of the CDJ, and in response to the needs of readers for information regarding publications on livestock and community development, selected works have been reviewed and listed. There is also information on training materials and opportunities.

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