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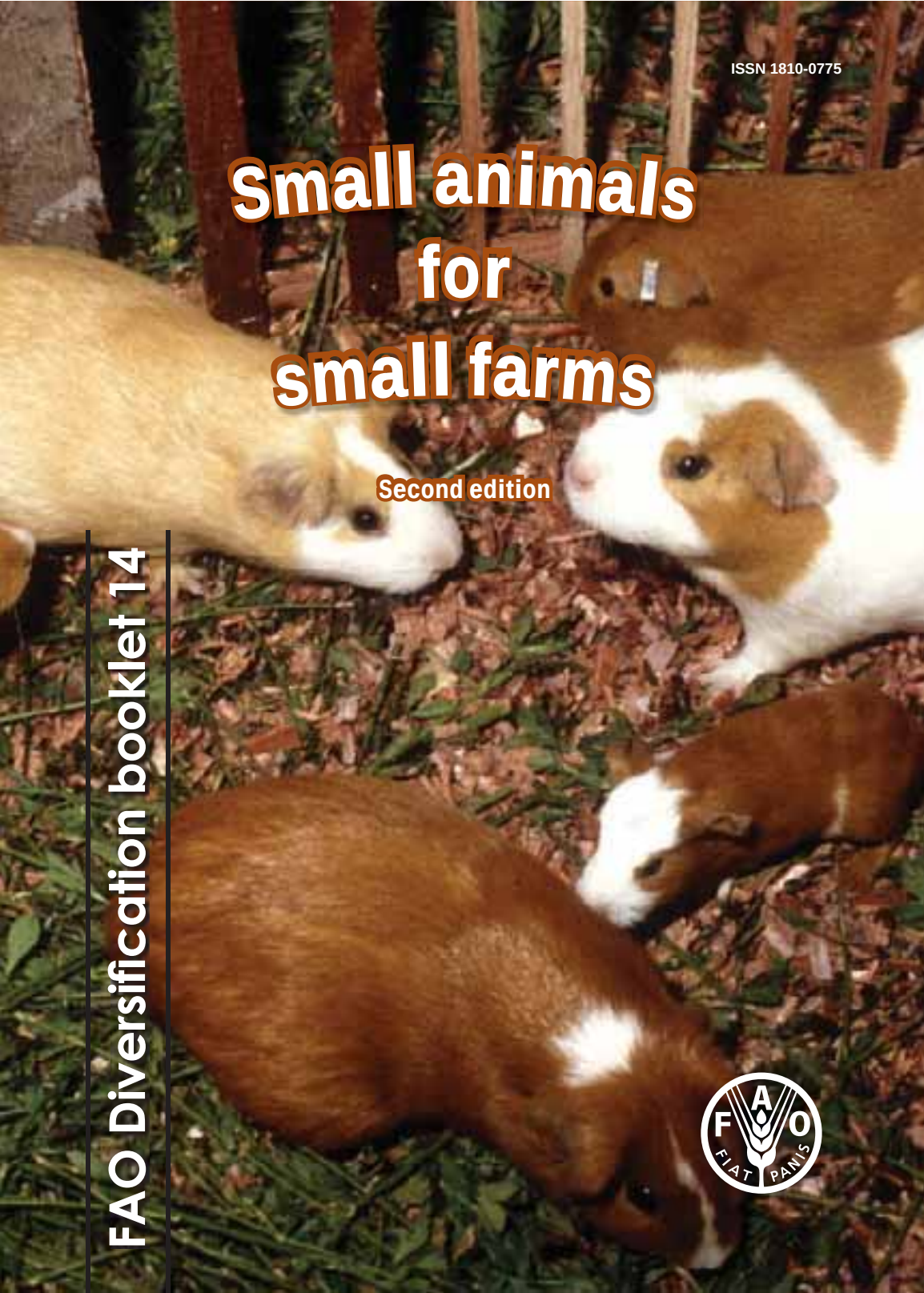
Small animals for small farms

Second edition

FAO Diversification booklet 14



Diversification booklet number 14

Small animals for small farms

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Preface

The purpose of the FAO Diversification booklets is to raise awareness and provide decision support information about opportunities at farm and local community level to increase the incomes of small-scale farmers.

Each booklet focuses on a farm or non-farm enterprise that can be integrated into small farms to increase incomes and enhance livelihoods. The enterprises profiled in the FAO Diversification booklets selected are suitable for smallholder farmers in terms of resource requirements, additional costs, exposure to risk and complexity. The products or services generated by the enterprises are suitable for meeting demand on a growing, or already strong, local market and are not dependent on an export market. However, in this particular booklet, export markets will be considered. This is because small enterprise development and local markets are influenced by international market demand for furs, hides and skins, and for some specific small animals' meat.

The main target audience for these booklets are people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries. It is hoped that enough information is given to help these support service providers to consider new income-generating opportunities and how these might enable small-scale farmers to take action. What are the potential benefits? What are farmer requirements and constraints? What are critical 'success factors'?

The FAO Diversification booklets are also targeted to policy-makers and programme managers in government and non-governmental organizations. What actions might policy-makers take to create enabling environments for small-scale farmers to diversify into new income-generating activities?

The FAO Diversification booklets are not intended to be technical 'how to do it' guidelines. Readers will need to seek more information or technical

support, so as to provide farmer advisory and support activities relating to the introduction of new income-generating activities. To assist in this respect, each booklet identifies additional sources of information, technical support and website addresses.

A CD has been prepared with a full series of FAO Diversification booklets and relevant FAO technical guides, together with complementary guides on market research, financing, business planning, etc. Copies of the CD are available on request from FAO. FAO Diversification booklets can also be downloaded from the FAO Internet site.

If you find this booklet of value, we would like to hear from you. Tell your colleagues and friends about it. FAO would welcome suggestions about possible changes for enhancing our next edition or regarding relevant topics for other booklets. By sharing your views and ideas with us we can provide better services to you.

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Acknowledgements for the series

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Introduction

Small animals

The livestock sector is an important source of income and provides improved livelihoods in many countries the world over. The growing demand for products of animal origin resulting from population growth, increased disposable income and lifestyle aspirations, especially in expanding urban areas provides small-scale farmers additional opportunities. Common farm animals are considered to be cattle, sheep, goats and pigs[1]. Most of these so called 'classic' livestock have traditionally been favoured in development projects. However, in other parts of the world, the major source of animal protein for people derives from 'small animals' or what are commonly referred to as 'microlivestock'. These 'protein sources' are constituted by more than one thousand kinds of rabbits, rodents, reptiles, birds, insects, other small animals (and fish). All these small animal categories are viable enterprises for small-scale farmers and worthy of mention. In this booklet, however, the focus is on creating awareness and promoting rabbits, rodents and reptiles (the '3 Rs') as viable enterprises for small-scale farmers in rural, peri-urban and urban areas (see Box 1).

[1] see FAO Diversification booklet No. 6 *Milk for health and wealth,* FAO Diversification booklet No. [8] *Higher value addition through hides and skins,* FAO Diversification booklet No. 9 *Sheep and goats for diverse products and profits,* FAO Diversification booklet No. 15 *Pigs for prosperity*

BOX 1 Rabbits, Rodents and Reptiles

Rabbits and Rodents

In addition to the well known rabbit, other mammals – mostly rodents – are suitable as small animals. Rodents include Guinea pigs, giant rats and cane rats (or grasscutters) as well as the capybara, although this is considered by some to be rather large for consideration as a small animal. Many of these small mammals are extremely prolific and highly adaptable. They often thrive on a diet of weedy vegetation and kitchen scraps. Their meat is higher in protein and lower in fat than more conventional meat. Other products such as skins and fur and occasionally manure can also be important for farm use or to sell.

Reptiles and Amphibians

Many larger reptiles including crocodiles and monitor lizards are used for food and other products. In some areas, for example Ethiopia, crocodiles have become accepted as farm animals. Smaller reptiles such as green and black iguanas are more 'user friendly' and provide meat and eggs as well as having valuable skins. Frogs are greatly appreciated as a delicacy in many parts of the developed and developing world.

Some small animal species, including notably the rabbit and Guinea pig, are completely domesticated and raised in recognizable production systems and often in close contact with their owners. Other species, including many small mammals and reptiles, are totally free ranging or only semi-domesticated. Some small animals are only collected in the wild although for many of these attempts at domestication – in order to preserve the wild resource – are being made. If this broad concept of small animals is accepted it is clear that they have been essential to human nutrition for thousands of years. In the future these small animals are certain to be of increasing importance in food security, environmental conservation, animal production and economic diversity.

Small animal production can be an important subsystem where land is scarce and parts of the community, particularly women and children, lack adequate income and nutrition. Economic niches not available to larger species are occupied by small animals. They are useful for people outside or at the margins of the cash economy because they require very little start-up capital, are a relatively small financial risk, produce rapid returns on investment and allow for a flexible production process. They also provide a steady source of food or income, generate employment, are likely to be successful because they are numerous, are easily transportable and are often efficient converters of feed to protein. Other benefits include the small size of the 'package', efficient use of space, low capital needs for housing (see Figure 1), use of non-conventional feeds, easy management, and provide numerous by-products.

FIGURE 1 Grasscutters in pen constructed mainly from local materials, Cotonou, Benin (Photo by R. T. Wilson)

Among the many advantages of starting a small animal enterprise are:

- they require little space;
- mostly they do not compete directly with people for food;
- they are usually socially acceptable and have few taboos;
- demand for their products outstrips supply;
- they generally have high reproductive rates;
- veterinary costs are relatively low;
- cash inflow arrives in a short period;
- financial returns are from high to very high;
- housing and other capital costs are low;
- nutritional and supposed medicinal value of products is high; and
- they require little foreign exchange for their operations but can contribute substantially to foreign exchange.

However, the strongest argument for promoting rabbits, rodents and reptiles is that people already make use of them. This recognises their value sufficiently to suggest that more attention should be paid to them at policy level, in research and development as well as in more geographical areas of the world.

Market potential

Market-oriented small animal production enables farming communities to produce surplus products that can be sold to consumers in rural, peri-urban and urban areas for the benefit of economic growth and the improvement of livelihoods in a rural community. This has the potential to create linkages between poorer rural areas and richer urban areas and contributes to a more equal distribution of the benefits from economic growth.

Almost 50 percent of the world population lives in urban areas. The trend to urbanization is expected to continue or even to accelerate. Apart from the ease of transporting such small animals to urban settings, production can be conveniently situated in urban and peri-urban areas as a result of limited space requirements needed by small animals. Small animals can be raised successfully in peri-urban and in urban centres as in rural and remote areas and production facilities are easily mobile. For example Guinea pigs and their cages can be moved from rural and remote areas into peri-urban and urban kitchen or vegetable or roof gardens easily (see

FAO Diversification booklet No.2 *Livelihoods grow in gardens*).

Small animals are not difficult to raise and require training that is not overly complicated. Production can easily be carried out by all members of the farm family: women and children as well as sick or disabled members of the farm family. Labour requirements are not excessive and the animals' small size and their confinement requirements mean that production can be located close to the homestead.

Earning a profit involves not only production but also and importantly marketing. One of the main elements in marketing is finding out what consumers need and want. Demand for livestock is growing faster in developing countries than the demand for staple crops. Typically such a rise in demand for animal protein is associated with higher levels of disposable income and more consumer sophistication. This means that consumer demand will focus on quality, regularity of supply and reasonable prices. All these elements can be provided fairly easily with small animals, so long as appropriate production practices are upheld, mainly concerning health and hygiene as well as appropriate and balanced feed.

Marketing also involves transport and most smallholders sell their livestock in the local village market. However, small animal production offers potential sales in urban markets because most of its output can easily be transported, for example by bicycle or on a bus. This clearly represents an opportunity for economic growth. Despite increased demand, however, it is easy to saturate local markets. One possible approach to increasing the market potential is the development of marketing associations which could share transport costs to larger regional markets. Developing a stable relationship with customers -- whether they are individuals, retailers or wholesalers -- is to ensure and guarantee a steady supply of product in order to make a viable business venture for all parties involved.

Profits for improved livelihoods

Effective poverty reduction measures can only be successful if the livelihoods of the rural poor can be improved and importantly maintained. Profits and the earning of profits is an essential element of any farm enterprise, including small animals. Small-scale farmers need profits so costs can be covered, fair returns on efforts to produce and

market the farm enterprises can be gained and importantly money can be put aside, in terms of savings, as well as investments can be made in productive assets. Productive assets are assets which have the capacity to generate more income, for example, investing money in new and better housing facilities for rabbits.

Small-scale farmers with small animals may not produce large quantities of meat, but carcass sizes are manageable and the 'harvest' is easy to process and store. Even if smallholders do not fully participate in formal markets and barter their products for other household goods cash is released for other and perhaps essential purchases. Other sources of income accrue from fur from Angora rabbits and chinchilla, rabbit skins, reptile eggs and the speciality skins of reptiles. Improved production techniques and better management can lead to considerably higher yields which could then be marketed more systematically. This in turn leads to a more even cash flow within and across a year which cannot be achieved by the very occasional sale of a 'large' animal. Small animals also contrast many food and cash crops that are harvested and sold only once or twice a year and with which the labour input is unevenly distributed.

Small animal production creates other jobs directly or indirectly linked to production through supplying inputs and services to farmers. Small traders, for example are an important and often a cost effective link between producers and consumers, while also generating income for themselves. Market-oriented development of small animals also creates a market for service providers such as transporters, traders, pharmacies, financial institutions, veterinarians, small shops and agricultural advisory services. Development of input and supply services generates economic activity and has a positive effect on rural livelihoods.

Purpose of the booklet

This booklet highlights the most important issues in the best use of small animals (rabbits, rodents and reptiles) in the expectation that development workers and policy-makers will recognize and act upon the numerous opportunities such small animals offer. This would not only result in improved livelihoods for producers but also assist in expanding employment and income opportunities in general. The booklet focuses on important aspects of this business.

In summary the aim of this booklet is threefold and is to:

- highlight the benefits of keeping small animals for small-scale farmers and the many opportunities they offer, not only in terms of income;
- identify the key inputs into smallholder livestock systems to improve productivity; and
- identify the range of support services required and the challenges of service provision.

Benefits of small animals

Small animals at household level

A well managed integrated production system comprising several diverse enterprises including small animal production adds considerable value to a farm household. There are synergistic benefits to integrated and associated farming systems. In addition there are several non-marketed benefits in relation to the function of animals as security and savings and as a means of financing sudden or periodic expenditure such as payment for medical expenses or school fees.

Small animals add to food security, improve human health through a more varied diet, generate a steady cash flow that increases household income, have an important role in poverty alleviation, contribute to the empowerment of women and children as well as the sick and the disabled and other marginalized groups, make productive use of labour and valorise local feedstuffs and feedstuffs not normally suitable for direct consumption by people.

CASE STUDY 1 **Guinea pigs and livelihoods in Bolivia**

In the forest margins of the tropical Bolivian provinces of Sara and Ichilo, some 100 km north-west of the city of Santa Cruz, farmers keep small animal species on their farms, generally to contribute to food security, although, in times of need, production not needed for home consumption, is sold. Under traditional management, poultry commonly scavenge around homesteads for the bulk of their feed, receiving only occasional supplements of household scraps and cracked grain. Pigs also scavenge, while receiving occasional offerings of chopped cassava, while sheep graze and browse along roadsides and in fallow-lands. They receive no vaccinations or veterinary treatment and find their own shelter where they can.

Although they receive no veterinary care, guinea pigs are the exception, since they are usually kept in sheds, or in the family kitchen, where they are fed freshly-cut forage, often of kudzu (*Pueraria phaseoliodes*). Monitoring showed that the productivity of chickens and ducks was reduced by the attacks of a range of controllable diseases and natural predators, while losses from pigs and sheep were as a result of accidents and internal parasites. Guinea pigs had few identifiable problems, with low levels of losses, restricted almost entirely to theft and accidents, often involving dogs belonging to neighbouring families.

CASE STUDY 1 **Guinea pigs and livelihoods in Bolivia** *(Cont.)*

As a result of the use of almost zero inputs, apart from the labour of women and children, the return from small animal species can represent up to 30 percent of annual family income, when home consumption is costed at the prevailing, local market prices.

Source: Adapted from Paterson, R.T. & Rojas, F. 2004. Small animal species in the livelihoods of small-scale farmers in Tropical Bolivia, In E. Owen, T. Smith, M.A. Steele, S. Anderson, A.J. Duncan, M. Herrero, J.D. Leaver, C.K. Reynolds, J.I. Richards & J.C. Ku-Vera (Eds.) Responding to the Livestock Revolution: the role of globalisation and implications for poverty alleviation, BSAS Publication 33, Nottingham University Press, Nottingham, United Kingdom, pp.117-132

Small animals and the farming system

Small animals are an important pathway of diversification and intensification in a wide variety of farming systems. Small animal production is a form of intensive agriculture. Large volumes of produce can be obtained from very small areas of land if the animals are provided with adequate water and food, and pests and diseases are controlled. They ensure better uses of the means of production including land, labour and capital. They can make excellent use of farm and industrial by-products.

Many kinds of small animals are best used locally in their native environment. Before attempting to introduce a new species or breed careful research should be undertaken. This should be designed to ensure that the animal to be introduced is not only adapted to local conditions but also that it will not become an invasive pest.

Environmental damage purportedly attributed to farming of conventional livestock has been well documented and perhaps overexposed. Small animals can, however, occupy niches that large animals cannot. Green iguanas, for example, have long been an important food source for eggs and meat in Central America, have been (and are increasingly being) semi-domesticated and can therefore occupy both wild and farm environments (see Figure 2). Rabbits, rodents and reptiles can enhance total farm yields and supply diversified products in a way that is compatible with many situations and in many farming systems. They can be highly productive in environments that are unsuitable for other kinds of animals: these include steep

FIGURE 2 Green iguanas on a farm in Costa Rica
(Photo by R. T. Wilson)

hillsides, highly degraded areas and urban localities. In some parts of the tropics large livestock may be totally unsuitable whereas local species of small animals may thrive. The use of locally adapted small animals reduces the pressure to alter the environment dramatically in order to accommodate conventional livestock production.

The development of small animal farming – one of whose principal objectives is to progressively abandon the uncontrolled harvest of these species and thus to prevent their extinction in the wild – requires a paradigm shift whatever species may be considered. Veterinarians, agronomists and animal production specialists trained along traditional lines need to modify their conceptions and attitudes and donor agencies should give further consideration to providing support for small animals as more and more technical and scientific knowledge and expertise are available in this animal production subsector.

Health and nutrition

Meat produced by small animals has a positive effect on family nutrition

both directly and by making more products available for consumption. Small animal meat, like all meat, is generally easily digestible, is an important source of protein and of essential amino acids, minerals (especially iron and zinc) and vitamin B for the family. Most of these nutrients are not present or present in only small and often unbalanced amounts in the staple starchy foods that comprise the major dietary intake of most people. Meat helps to alleviate protein deficiency, contributes to improved growth and physical activity in children and to better health and less disease in the family. Well fed and healthy children – and there are far too few of these across the world – suffer less from learning difficulties than do children who do not possess these characteristics. Animal foods provide a particularly dense combination of critical nutrients. Consumption of meat (and of other livestock products such as milk and eggs) also helps in the fight against HIV/AIDS through boosting the immune system. People infected with HIV/AIDS need to eat more saturated fats in order to help augment the blood cholesterol level. The rapid reproductive cycle and high rates of growth of the animals provides for a regular supply and relatively large source of food (see Box 2).

Food security

Food security is now a priority objective worldwide. In very recent times (prior to 2010) it has been recognized even by politicians in the Western world as a potential source of conflict. Food security (or rather insecurity) was considerably exacerbated over the last 20 years of the twentieth century as increased human populations began to approach or exceed the capacity of land to support them. The problem will intensify as the numbers of people continue to grow and especially in the developing

BOX 2 The nutritional value of Rabbit meat

Rabbit meat has a high protein content of about 21 percent and a low fat content of around 8 percent. Rabbit meat is low in stearic and oleic acids with a high proportion of polyunsaturated linolenic and linoleic acids. Some vitamins, notably nicotinic acid and calcium pantothurate, are higher in rabbit than in other meats and calcium and phosphorus are also high. Rabbit meat is thus a good source of protein and some other essential elements and is relatively low, at 160 kcal/100 g meat, in energy.

countries and in many areas it will be associated with a continuing rapid increase in urbanization. The overall effect of increased human populations on agriculture will be greater demand for human food, competition for animal feed resources and increased pressure on land. The major challenges are to increase food production, improve productivity and ensure that systems are sustainable. Equally important are distribution and accessibility of food to ensure that a balanced diet is available to everyone.

Increased food production must not, however, be achieved at the irreversible expense of the environment and especially overexploitation of marginal land, more pollution and loss of biodiversity. Small animals are an important resource that are able to contribute to meeting the increasing demand for animal protein, especially in the developing world. Small animals contribute to food security in various ways but perhaps especially because they are characterized by high reproductive and growth rates and can thus produce large quantities of nutritious food in a short period. They play a disproportionately large role in food security systems as they thrive on degraded vegetation and non-conventional feeds and are often crucial to household nutritional strategies. They usually demand reduced labour inputs, are resistant to disease and provide nutritional diversity. This is especially important in regions where increasing dependency on cereal staples such as maize can lead to vitamin deficiency diseases.

- ***Equity, gender development and opportunities for the disabled***

Small animal production initially involves small-scale activities that require some skills but usually low capital investment. It can combine well with traditional domestic roles and this makes it an accessible livelihood option for people with limited resources, including women, children and old people (see Case Study 2). Very few animals are sufficient initially to participate in production. Even the landless poor can keep small animals. In the longer term, however, smallholders will need more animals in order to develop a profitable enterprise.

Small animal production should have a positive or, at worst, a neutral impact on the most vulnerable members of the household and the community. It may be necessary to undertake some gender awareness activities in the community to ensure people understand why it is

CASE STUDY 2 **Smallholder rabbit production in south-western Nigeria**

A combination of ultrasmall (keeping two or less breeding does) and small units (three to 10 breeding does) constitute 80 percent of all rabbit farmers in south-western Nigeria. Medium scale (11 to 50 breeding does) accounted for 15 percent of units and large scale (greater than 50 does) the final 5 percent. Rabbit farmers cut across all ages and professions including retired persons. The primary reason for keeping rabbits was for home consumption with occasional sale of surplus stocks. The market chain involved direct sale of live animals to consumers or other farmers. Some 57 percent of rabbit keepers indicated that all members of the family were involved in animal care and management. Breeds used were invariably crosses among imported commercial meat type rabbits (mainly New Zealand White, Californian and Chinchilla). There was no reliable and steady supply of breeding stock, so foundation and replacement stocks were mostly acquired from friends and other smallholder farms. There was no standard type or design of animal house and use was made of assorted materials (wood, wire mesh, tires, etc.) in the construction of rabbit cages. Cages were mostly single-tiered and placed outside the house. Mating of does was seasonal as a result of seasonal heat stress. About 70 percent of the farmers noted that doe receptivity and conception rates were markedly low during the dry season. Principal constraints facing the units included getting reliable and stable sources for foundation/replacement stocks, feeds, theft and access to information on rabbit management.

Source: Adapted from Oseni et al.2008. Smallholder rabbit production in Nigeria, 9th World Rabbit Congress, June 10-13, Verona, Italy

important that people are rewarded for their efforts. It may also be necessary to find innovative ways of strengthening control by the normally disadvantaged over their earnings, for example by promoting group savings. Social and organizational factors that contribute to whether or not production is successful and provides for growth include:

- women's involvement and their control over any income that is generated;
- the availability of labour; and
- community or cultural factors that facilitate production and trade.

Development of small animal production can make a strong positive contribution to the empowerment of the marginalized members of society whether they be rural or urban or men, women or children. Small animal production can contribute to equal participation and involvement in economic growth. Women's

involvement in management of assets and cash income – for example through membership and leadership of producer associations – increases their social status and their influence on decisions important for the daily life of many families. Small animals are almost perfectly tailored to small and landless farmers as they require neither large capital (investment) nor recurrent costs. Small animals provide employment opportunities for the socially more vulnerable sectors of the population including women, children and disabled persons (see Figures 3 and 4). In this context they are an important factor for social promotion.

Throughout much of the developing world women and children primarily undertake small animal production. It is important to ensure that they also participate in sharing the benefits of their labour, especially as production enterprises become more commercialized.

FIGURE 3 Boy with rabbits ready for market, Western Escarpment, Burundi
(Photo by R. T. Wilson)

FIGURE 4 Women feeding Guinea pigs in Peru
(Photo: FAO/17459/A. Odoul)

Women and youths must also be involved in marketing their produce as well as in retaining control over the money they earn. This will not only allow women to become more self-sufficient and independent but will also increase their capabilities in looking after the family and improve their social status in the immediate household and wider community.

Improved use of resources is a valuable background and introduction to more active participation in policy formulation and rural development planning. Even greater participation with a stronger voice can be helped by 'professional' organizations which can arise from the keeping of small animals.

Financial rewards

Small animals can have many financial advantages compared to raising larger animals and especially for small-scale farmers. Conventional stock by their very nature must be bought and sold in large units. Saving up to buy a cow may take a very long time and if an accident or illness occurs the entire investment is lost.

Investment in small animals can initially be small and then incremental. It is also spread over several units and thus contributes considerably to reduced risk. Smaller animals reach sexual maturity faster and can reproduce quickly which further expands the investment. Several types of small animals are raised in backyards or inside the home and do not require large areas of land per unit of output. Production for home use and/or market is distributed more evenly throughout the year which results not only in more even subsistence but also can contribute to a steady income that can be more easily controlled in response to market conditions. Most small-scale farmers cannot hope to compete in the market with large, high input, single species industrial enterprises but can perfectly well cater to specialized niche or exotic markets and obtain a good price for their product (consumers in Ghana pay up to three times more for meat from cane rats or grasscutters than they do for beef, for example). Small animal products are also capable of providing higher incomes through processing into value added products.

As familiarity with production technology increases, the rewards for developing husbandry skills increase and the potential for increasing financial rewards is enhanced. In promoting small animal production emphasis should be put on the potential to provide good nutritious food for the family while concurrently developing the concept of marketing surplus produce and additional non-food products for cash.

Key steps in the livelihood activity

The right species and breed: rabbits, rodents and reptiles

Rabbits

Rabbits belong to several genera in the subfamilies Leporinae (which includes the similar hares, *Lepus* spp.) and Palaeologinae of the family Lepidae in the order Lagomorpha in the superorder Glives. "Rabbits" are found commonly in many parts of the world. Most rabbits in the broad sense have developed a digestive system, known as coprophagy, analogous to rumination. Feed is partially digested, voided, the faeces re-ingested and digestion then completed.

The true rabbit, *Oryctolagus cuniculus*, comprises several subspecies. These were originally native to southwest Europe and North Africa. The rabbit was known in Spain about 3 000 years ago and it spread, as the Roman empire expanded, throughout as a game animal. It was later reared in fenced enclosures that usually had stone walls (called '*leporaria*'), for sport and to provide foetuses and newborn rabbits (known as *laurices*), for consumption by the Roman garrisons and later by monks. These 'leporaria' are the origins of many European warrens where large numbers of rabbits are still found.

Rabbits were truly domesticated around 1 600 AD when European feudal systems (in which only landowners had the right to own rabbits) were abolished and keeping rabbits in hutches or cages became widespread. Rabbits as domestic animals have undergone several cycles of popularity and decline and have been especially popular during wars when other meat was not easily available. Precocity and prolificacy enable very rapid population expansion and the use of quantitative genetics has enabled 'broiler' rabbits to compete with similarly managed domestic fowl. Europe remains the centre of production in terms of overall volume but consumption per person is highest in tropical and subtropical countries.

Rabbits are relatively easy to rear, manageable in small units and do not necessarily (and in smallholder systems should not) compete directly for human food. They are eminently suitable to smallholder production (see Figure 5) and, while there may be some initial resistance to eating them, there are no major entrenched taboos.

Many traditional breeds of rabbit have been used over the years to

FIGURE 5 Rabbits in a small-scale production system
(Photo: FAO/14106/ Ch. Errath)

produce meat, fur and skins. Several western European countries had a large number of breeds of varying size and reproductive and growth performance. Modern fast growing and prolific breeds, such as California Hyline, New Zealand White and Chinchilla (not to be confused with the rodent of that name) (see Figure 6), reach weights of 2.2 kg at 80 to 90 days. Dressing percentages are 60 to 70 percent and increase with age, independently of weight. The higher value hind quarters and loins comprise about three-fifths of the carcass. Carcass yield is slightly less in animals fed bulk roughage feeds as this tends to cause development of the digestive tract but this is offset by the reduced cost of feeding.

Some species that are not lagomorphs show similar morphology to the rabbits. The *viscacha* (a Spanish word from the Quechan Indian language), *Lagidium viscacia*, a rodent of the upper Andes, is native to southern Peru, most of Chile, and parts of Bolivia and Argentina. It has a head and ears that could lead to it being confused with the true rabbit but its very short front legs and long tail serve to distinguish it. The long greyish-coloured fur, often tinted with a rich

FIGURE 6 Chinchilla breed meat rabbits in a modern unit, Lumle, Nepal (Photo by R. T. Wilson)

brown hue, is similar in composition to, but not as valuable as, that of the chinchilla, to which it is very closely related.

Rodents

The order Rodentia comprises more than 2 200 species and 40 percent of all mammal species are rodents. They range in size from tiny (the African Pygmy Mouse weighs 7 g) to quite large (the Capybara weighs up to 80 kg). Many species of rodent are suitable or potentially suitable for small animal production either as fully or partly domesticated stock. They produce meat (rats, capybara), fur (coypu, whose fur is the highly valued 'nutria' and chinchilla of even more value) and skins or hides. A few only of this vast range of animal life are described as examples of the order.

Chinchilla, along with the rabbit-like viscacha, belong to the family Chincillidae. There is little noticeable difference between the two species of chinchilla except that *Chinchilla brevicaudata* has a shorter tail, a thicker neck and shoulders and shorter ears than *C.lanigera*. The latter species, from which domestic chinchilla are thought to descend, is now rare in the wild. It is everywhere

illegal to hunt wild chinchilla but outside the domesticated types they are on the verge of extinction because of continuing illegal hunting. Chinchillas are gentle, timid and intelligent animals. An adult animal can grow up to 30-36 cm long including its bushy tail which alone can measure up to 12.5 cm. A fully grown animal weighs between 600 and 800 g.

Guinea pigs belong to the genus *Cavia* of the family Cavidae in the order Rodentia. Domestic Guinea pigs are also known as cavies, a corruption of the Quechan '*cuy*', the onomatopoeic South American Indian word derived from the animal's alarm call. The domestic species *Cavia procellus* is native to the South American Andes. It had already been domesticated and was familiar to the aboriginal Inca and other populations of the highlands of Peru, Ecuador and Colombia by the time the Spaniards arrived in the New World (see Figure 7). Guinea pigs rarely weigh more than 1 kg at maturity. They do not burrow although they have four strong claws on the front feet and three on the hind. Several domesticated types have developed. The Peruvian is a rather large variety with long silky hair. The English or Bolivian breed is a short-haired type. An 'Abyssinian' type has hair in a series of whorls.

Cane or African giant rats of the genus *Cricetomys* and grasscutters of the genus *Thryonomys* of the family.

FIGURE 7 Guinea pigs in a traditional system, Cuzco, Peru
(Photo by R. T. Wilson)

Thryonomidae are widespread in Africa in all except the driest areas (see Figure 8). They appear to be commoner in West Africa than elsewhere but this is possibly because they are seen more often offered for sale on roadsides and in markets as they are used as food. The West African rat that is most used for food is *Cricetomys gambianus* which is mainly a species of the savanna areas. *Cricetomys emini* is also used for food but is more restricted in distribution and occurs only in rain forests. Giant rats are burrow-dwelling, usually solitary and prefer damp or wet places although the few reports on their ecology are conflicting. The West African grasscutter, *Thryonomys swinderianus*, is a large non-burrowing rodent. Cane rats range in body length from 35 to 60 cm. They commonly weigh 6-7 kg in captivity but some wild specimens attain 10 kg. They are heavily-built rodents, with bristly brown fur speckled with yellow or grey. Other 'rats' are also important food species in some areas.

The capybara, *Hydrochoerus hydrochaeris* (suborder Cavimorphae, family Hydrochoridae, subfamily

FIGURE 8 A grasscutter in a small-scale production system
(Photo by R. T. Wilson)

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Cavioidae), is the largest rodent in the world (see Figure 9). The capybara is indigenous to and widely distributed in lowland tropical South America where it is known by several local names. This semi-aquatic animal is rarely found more than 500 metres from open water. The subspecies *H.h.hydrochaeris* extends from the eastern plains of Columbia, through Venezuela, Guyana, French Guiana, Surinam and to the Amazonian parts of Ecuador, Peru and Bolivia, hence the whole of Brazil, Paraguay and Uruguay and to the northeast of Argentina. The subspecies *H.h.isthmius* has a separate distribution in Panama, western Columbia, western Venezuela and the Pacific coast of Ecuador. Many capybaras are kept in captivity around the world. They are of a quiet disposition and quickly come to accept being handled.

Reptiles

Reptiles of the class Reptilia are air-breathing and generally 'cold-blooded'

FIGURE 9 A Capybara in Brazil
(Photo: FAO/1855/ A. Brack)

(poikilothermic) animals whose skin is usually covered in scales or scutes. The four living orders are Crocodilia (crocodiles, gavials, caimans and alligators [23 species]), Sphenodontia (tuataras from New Zealand [2 species]), Squamata (lizards, snakes and worm lizards (about 7 900 species) and Testudines (turtles and tortoises [about 300 species]). Most reptile species are oviparous (egg-laying) although some squamates are either ovoviviparous (egg retention) or viviparous (give birth to live young which they may then care for). Extant reptiles range in size from a tiny gecko, *Sphaerodactylus ariasae*, that grows to only 1.6 cm to the saltwater crocodile, *Crocodylus porosus*, that may reach 6 m in length and weigh over 1 000 kg.

Many reptiles have been important contributors to human welfare for millennia. They provide meat, eggs and skins and are often a source of supplementary income when they are shot, trapped or hunted with dogs over much of Asia, Africa and South America. Several species of smaller reptile are suitable for domestication or at least for commercial production. Most attention in the recent past (other than the large number of species kept as 'pets' or companion animals) has been given to the iguanas of Central and South America. These are mainly herbivorous species of the genus Iguana in the family Iguanidae of the order Squamata in the class Sauropsida. These reptiles feed mainly on leaves, flowers and fruits and are likely to be more suitable for smallholder production than carnivorous reptiles. The species about which most is known is the green iguana *Iguana iguana*. It is likely that its close relatives the black or spiny-tailed iguanas including *Ctenosaura similis*, *C.acanthura*, *C.hemilopha* and *C.pectinata* have similar characteristics. The common South American name for green iguanas is '*gallina de palo*' or 'chicken of the trees'. Green iguanas are found in their preferred tropical lowland forests usually close to water in central and northern South America and several Caribbean islands (and there are some feral populations in parts of the United States of America). Spiny-tailed iguanas have a more restricted distribution in Central America in drier open woodland areas. One other genus which may prove suitable as small animals is *Tupinambis* which includes *T. rufescens* and *T. teguixen* both are known as tegus. Tegu, like crocodiles, produce a valuable leather and, although they are most common in Argentina and Paraguay they are

found as far north as Colombia and on the island of Trinidad.

Smallholder production systems

Rabbits

Rabbits are very suitable for intensive management systems and in recent years the use of quantitative genetics, along the lines of those used for poultry broiler production, have improved their productivity. Hybrid lines capable of high reproductive rates and very good feed to meat conversion ratios are readily available (see Table 1). For production other than for home use and a small surplus for sale, maximizing the reproductive rate is the major factor affecting productivity.

Management of a rabbit enterprise is possible at three reproductive levels. In extensive systems gestation and lactation are not concurrent events: young are weaned naturally at 5 to 6 weeks, does are bred after weaning and give birth every two and half months. In semi-intensive cycles, does are bred 10 to 20 days after kindling and young weaned at 4 to 5 weeks. There is some overlap of gestation and lactation but for 60 to 65 percent of the time does are only pregnant or only lactating. In intensive systems does are served on the day, or at the latest within four days, of kindling. Weaning should take place not later than 28 days after parturition and a reproductive cycle of less than 35 days is possible.

TABLE 1 **Production characteristics and trends in intensive rabbit systems in Europe**

Parameter	Year			
	1950	1960	1970	1980
Number sold/breeding female/year	<25	30	45	60
Interval between litters (days)	>90	70	54	42
Ratio concentrate feed: gain		6.0	4.5	3.6
Rabbit type	Unselected	Pure breeds	Pure breeds x improved bucks	Hybrids
Man hours/doe/year	16.0	16.0	10.0	7.5
Labour (min)/carcass (kg)	27.0	22.0	9.5	6.2
Unit size	80 - 100	100 - 150	200 - 250	350 - 1000

Source: Adapted from FAO, 1997a

The most intensive system should only be attempted where conditions are optimal. Progressive breeders adjust cycles to feed availability and doe condition. Females with 7 to 8 young are usually mated immediately whereas those with larger litters are held back a few days. Feed intake and nutritional needs vary with age and reproductive status and less energy is needed in warmer than colder conditions. At 30 °C energy demand is 50 percent lower than at 5 °C but weight gains are reduced by about 30 percent. Water requirements are greater at higher temperatures.

Production systems in the tropics are still at an early stage of development. In the Caribbean, for example, the levels of production (see Table 2) are comparable to those achieved in Europe in the 1950s (see Table 1). It should be possible, however, to increase production and productivity very rapidly by drawing on European experience and adapting it for the tropics.

TABLE 2 **Rabbit performance in the Caribbean**

Trait	Unit	Mean
Reproduction		
Litter size (total young)	Number	5.0
Litter size (born alive)	Number	4.5
Litter size (weaned)	Number	3.5
Pre-weaning mortality	Percent	20
Age at first mating	Months	6.0
Period between parturitions	Days	80
Litters/year	Number	4
Young/doe/year	Number	12 - 16
Reproductive life	Months	12 - 18
Age at culling	Months	18 - 24

TABLE 2 **Rabbit performance in the Caribbean** *(Cont.)*

Trait	Unit	Mean
Growth		
Birth weight	grams	45
Weaning weight (28 days)	grams	320
Weight at 13 weeks	grams	1600
Pre-weaning daily gain	grams	10
Post-weaning daily gain	grams	22
Mature weight	grams	3000
Dressing percentage at 13 weeks		52
Post-weaning feed efficiency (concentrate:gain)		3.6

Source: Adapted from Rastogi, 1989

Rabbits are sometimes selective feeders but will eat a wide variety of plants. In modern systems a series of standards have been established for different production stages. Protein quality, determined by essential amino acid levels (especially methionine, lipine and arginine), is as important as quantity. Unbalanced proteins reduce growth rates by up to 14 percent and increase the normal feed conversion ratios of 3:1 to 4:1 for intake/gain. Attempts to replace true proteins with non-protein nitrogen, such as urea, have not been successful.

Rodents

The Spaniards discovered the chinchilla in 1524 and shortly afterwards Queen Isabella of Spain was presented by one of the early explorers with a chinchilla coat. It was to be another 350 years, however, before Sir John Murray,

an Englishman working in Chile, set up the first known chinchilla breeding farm in 1874 and tried to develop the domestic animal. Over the next 50 years various attempts were made to set up chinchilla 'ranches' with animals of both wild caught or bred in captivity.

Cane rats have been extensively hunted in the past although in the savanna area of West Africa people have traditionally captured from the wild and fattened animals in captivity. Cane rats are not the most prolific of rodent species but the high demand, attractive market price and the small amount of investment required make them a suitable small animal activity for income generation in many parts of West and Central Africa. Research carried out towards the end of the twentieth century has allowed the selection and improvement of stock for captivity and much of the knowledge and techniques for cane rat breeding has been determined from work carried out at the Benin-Germany breeding station which was established in the mid-1980s (see Case Study 3). Practical information is now more readily available for farmers interested in cane rat breeding. This is reflected, for example, in countries bordering the Gulf of Guinea where commercial grasscutter farms, each with more than one thousand animals, are achieving high levels of production and productivity.

Many capybara are still taken from the wild by traditional (and modern) hunters. The species is, however, eminently suitable for raising as a domestic animal in both extensive and intensive systems. The capybara is easy to handle once it has become tame. It has been shown at several locations in South America that captive breeding and close confinement for intensive or semi-intensive production is quite feasible. Disease problems might, however, be somewhat severe if husbandry is not of a high standard. Pens should contain only one male or there will be considerable fighting. For extensive production (i.e. free range grazing) enough room must be allowed for the animals to select their preferred feeds or losses from starvation might be exceptionally high. Under this type of management it is claimed that capybara are three and a half times more efficient than cattle and bring in cash returns three times higher than cattle when the two are stocked together.

CASE STUDY 3 **Grasscutters in West Africa**

Wild grasscutters and cane rats are victims of their success with consumers and becoming increasingly scarce in areas surrounding the capitals of West and Central Africa. In Côte d'Ivoire hunters kill an estimated eight million wild grasscutters every year. At present the concept of rearing small game is mainly taking hold in countries where bush meat is firmly entrenched in local dietary practice as in the Congo basin. In Gabon consumption of game is said to be twice that of beef. Développement d'Alternatives au Braconnage en Afrique Centrale (DABAC) is a project financed by the European Development Fund (EDF) aimed at developing alternatives to poaching in Central Africa. It has been attempting to satisfy some of the high demand by rearing game on the outskirts of towns, most of which is sold without the use of middlemen on the urban markets. First launched in Gabon the project now also operates in Cameroon and Congo. Almost anyone can start a small household activity based on a few grasscutters but scaling up to the next level of a viable and regular output with a view to regular sales is altogether more challenging. Success depends largely on developing clear technical strategies based on sound veterinary and animal husbandry research and the diffusion of affordable production methods that are suited to small-scale producers. Rearing grasscutters has proved successful in West Africa thanks to years of research on all aspects of this type of farming including buildings and equipment, feeding, reproduction, health and livestock behaviour. Studies began in Ghana, Côte d'Ivoire and Nigeria in the 1970s before being launched in Benin with support from the German development corporation GTZ. The primary objective of this joint Benin-German project was to resolve problems linked to grasscutter habitat, captivity and disease. The experience gained in Benin should soon be made available to farmers in other sub-Saharan African countries as far down as South Africa through the creation of national networks.

Source: Adapted from Spore.2008. Mini-livestock keeping: Think big with minilivestock, No. 133 (Available at http://spore.cta.int/index.php?option=com_content&task=view&id=343&Itemid=99999999)

Reptiles

Reptiles have been traditionally exploited for centuries by hunting and capturing in the wild or by taking their eggs after they have been laid by the female. In South America, however, as in Africa for the Nile crocodile some species have been hunted so ruthlessly that they are now endangered in many areas. In much of Central and South America iguanas are the preferred game animal and are hunted regardless of sex and reproductive status so that egg-carrying females are taken to the detriment of the population as a whole. Because of the green iguana's popularity in the pet trade (more than 800 000 were imported into the United States of America in 1995 alone) and as a food source in

Latin America they are listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), also known as the Washington Convention, Appendix II, as a species whose "trade must be controlled so as to not harm the species in the future". Captive breeding or domestication has several advantages over indiscriminate and uncontrolled hunting including the much higher survival rate of young (more than 90 percent of young wild iguana may be taken by predators in the first few months of life) and the possibility of restocking wild populations. For example, in an iguana farming project in Panama and Costa Rica which raised more than 10 000 green iguana in its first five years of operation, pens were constructed of sheet metal sunk 30 cm into the ground with each enclosure having ample shelter made from bamboo and other vegetation. These shelters protect the lizards from predators, are raised from the ground and food is provided underneath. Some 20 to 60 young iguanas can be kept on 10 m². Tunnels provided as artificial nest sites can ensure almost 100 percent hatching (see Case Study 4).

CASE STUDY 4 **The green iguana in Costa Rica**

Every year in early spring female green iguanas climb down from the tall trees of Costa Rica's rain forests and lay their eggs in sandy beaches along the ocean. And every year people are waiting to catch and eat them. Eating iguanas, which the local people call 'chicken of the trees' is an ancient tradition in Costa Rica. Spring is the best time for Costa Ricans to trap iguanas as pregnant females move slowly when they are weighed down with dozens of eggs. Now, because of these hunts, climate change and loss of habitat, iguanas are in danger. The Costa Rican government now forbids hunting iguanas but that does not stop the local people from still enjoying one of their favourite traditional dishes.

Edsart Besier, a Dutch conservationist who founded the Iguanaverde Foundation in 2001, is one of several people trying to save the green iguana from extinction. Some have created refuges for green iguanas in their natural habitat whereas others are training farmers to raise them for food so there will be plenty of iguanas for future generations. Even though they face many obstacles these environmentalists still believe their work is making a difference. "I'm very positive" Besier said. "The project is growing a lot every year. Every year we get a lot more knowledge, and people write about it. There is publicity about it, and in the area it is very well known, in a positive way. I have never heard negative things, other than from local kids who walk on the street, especially at Easter time when they catch the iguanas. They don't look at me that friendly, but that's fine. I can live with that."

CASE STUDY 4 **The green iguana in Costa Rica** *(Cont.)*

Besier estimates there are less than 2 000 green iguana left along the southern part of Costa Rica's Caribbean coast. Researchers at the National University of Costa Rica say that is about one third of what there should be in order for the species to survive. So with money he raises from renting cabins to tourists and from donations, Besier has created a safe place where females can lay their eggs without being caught. Besier collects iguana eggs and takes them to an 800-square-mile reserve near the town of Punta Uva on the Caribbean Coast in the Gandoca-Manzanillo Wildlife Refuge.

In 2009 the females laid about 400 eggs, the biggest number yet. A big part of Besier's project is educating local school children about the iguana's plight. He helps students raise iguanas and set them free in the wild. He wants to show them that there are other ways to think about iguanas besides food. Sometimes he takes students to the Kekoldi Indian Reserve where Gloria Mayorga Balma and the Kekoldi tribe have been raising iguanas on a farm in the damp rain forest for 15 years. Balma makes sure the iguanas' sandy nesting boxes are covered with a black tarpaulin and the eggs are kept warm. When the eggs hatch at the end of summer she moves the tiny green reptiles to another cage, where they spend the next two years. They are then set free. Balma said she worries about losing the forest to banana plantations and timber companies but her biggest concern is that local people still steal iguanas from the farm. Yet she, like Besier, remains hopeful and says the best hope is educating children so that the future can be different for the iguana.

Source: Adapted from Miller, A. 2009. Saving Costa Rica's Green Iguanas (Available at http://teacher.scholastic.com/scholasticnews/indepth/endangered_species/news/index.asp?article=gr)

Peri-urban and urban production systems

Intensified production systems for small animals are required not only in rural areas. Urban and peri-urban systems must be further developed and intensified to secure a continuous supply of fresh produce to the human populations living in these areas. Animal production within and around cities is already a preferred activity for many unskilled migrants. Individual household plots, waste ground and roadsides are propitious sites for increasing the family food supply and for producing a small surplus to sell. City farmers have developed small and medium sized enterprises specializing in producing animal products for sale in city markets. This activity is becoming more popular especially as it provides employment and income for women and young farmers.

Housing

For many of the species considered in this booklet suitable housing is important for protection from weather and from predators. This does not mean that it should be sophisticated and expensive. On the contrary it should be simple, cheap and constructed whenever possible from local materials or even materials scavenged from other enterprises. A guiding principle in considering housing should be to take into account animal health and animal welfare. Water should always be available and food should preferably be offered in clean receptacles or containers. Suitable materials for housing include bamboo, local wood, wire mesh, expanded metal and thatch (see Figure 10). In appropriate cases adequate provision for ventilation or the circulation of air should be made.

FIGURE 10 Wire mesh cage with automatic drinker and food container, Cotonou, Benin (Photo by R. T. Wilson)

Rabbits are gregarious animals and outside the individual breeding pens they should be given a considerable amount of space in which they can exercise and socialise. They are also burrowing animals so any pen should either be gnaw proof with a hard (concrete) floor or the walls – which may be of wire netting, corrugated metal or brick or concrete – should be set top at least 60 cm below ground. Hutches for breeding does should provide a floor space of 0.45 m □height of 0.75 m for an individual doe and, when they are pregnant, a separate but attached nest box with an area of 0.4 m with a height of 0.3 m should be provided. Not too much money needs to be spent on housing so that capital input costs remain low and maintenance can be simple and effective where local materials are used.

Chinchillas are rock hoppers that like to scurry about so they prefer floor space in their cages rather than height. Cages should be made of welded wire mesh of at least 16 gauge thickness with the holes no larger than 1.9 cm square. Raised wire floors allow droppings, urine and partially eaten food to fall through as the chinchilla is a clean animal that does not like its fur to become soiled.

Grasscutters can be kept in individual cages or in purpose built pens (see Figure 11). Considerations for safe and secure housing are similar to those already described for rabbits. Capybaras are social animals that live in family groups. All members of the group cooperate in defence and nurturing of the young. As capybaras are semi-aquatic they must have access to water at all times and should also be provided with shelter from the sun. Capybaras are best kept in large secure paddocks where they can graze freely.

Green iguanas need to live in an environment with high humidity. If kept outside their natural environment they will need to be provided with adequate sources of water to ensure they can create their own microclimate. Green iguanas will thrive only in temperatures of 35°C and above and must have appropriate sources of light either naturally or artificial. If these conditions are absent their bodies cannot produce the vitamin D that promotes calcium absorption which can result in a metabolic bone disease that can be fatal.

FIGURE 11 Grasscutter in wire cage with yam offered as feed, Nungua, Ghana (Photo by R. T. Wilson)

Feed and water

The statement that 'water is essential to life' is as applicable in small animal production as it is elsewhere. Clean cool water should be available on a permanent basis to all species of animal. Feed requirements vary according to the animal in question.

Small animal production is based largely on the feeding and consumption of otherwise difficult to valorise farm products or even wastes including stalks, straw, hulls, vegetable residues and other plant material that cannot be used directly for human consumption. Such resources are usually available at very little or no cost. Off-farm wastes from industrial crops or agroprocessing including molasses from sugar, brewers grains, oilseed cakes, cereal by-products like bran, pulp from citrus crops converted to juice and vegetable trimmings from canning processes can also be made use of.

Rabbits grow best on feeds with 220-240 calories digestible energy per kilo of animal weight. In low intensity and smallholder systems many local plants can be used to reduce costs. In Malawi, for

example, a roughage supplement of *Amaranthus* is used along with maize grain and bran , groundnut cake and a pinch of salt, and this allows does to produce 20 young per year and young rabbits to grow at 15 g per day for up to 16 weeks. Groundnut haulms are fed in Burkina Faso as well as *Brachiaria ruziziensis. B.mutica* is used in the Philippines and could prove useful elsewhere in the tropics. Cassava leaves and peel are used in Ghana but both need balancing with protein and fibrous feeds. Bananas, coconuts, prickly pear, potatoes and many legumes and grasses are also fed to rabbits in many parts of the tropics.

The Guinea pig is a monogastric herbivore, able to adapt to whatever food is available. Of the three possible feeding systems, one is based exclusively on fodder, a second is a mixed option consisting of fodder plus a concentrate, and a third is based on concentrates plus water and vitamin C.

Cane rats and grasscutters are mainly herbivorous but will eat many kinds of food. In the wild, cane rats eat mainly palm fruits and tubers, particularly yams, plus a variety of other fruits, seeds and insects. There are some differences in dietary preferences between males and females. In captivity cane rats will eat yam, cassava and plantain peels, maize chaff and cocoyam and yam tubers.

The capybara is a herbivore that feeds mainly on grasses and aquatic plants but it also eats fruit and tree bark. An adult will eat 2.7 to 3.6 kg dry matter of grasses per day. This animal, like the rabbit, is coprophagous and uses its own faeces as a source of bacterial gut flora and in order to help digest the cellulose in its normal diet and extract the maximum protein. Capybara may also regurgitate food to masticate it again and in a manner similar to cud-chewing by a cow. Average daily gains of 130 g have been achieved for capybara weighing 15 to 20 kg fed a diet of 50 percent elephant grass (*Pennisetum purpureum*) cut at 7 weeks of growth and 50 percent concentrate. The conversion rate of feed to gain in this weight range is about 5.9:1.

Iguanas have a specialized digestive system in which food is broken down by bacteria in an enlarged fermentation chamber. Food is converted to meat in a manner similar to that of ruminants but the process takes relatively longer. Juvenile iguanas often eat faeces from adults in order to acquire the essential microflora to digest their low quality diet. Both green and

black iguanas are mainly vegetarian but the latter also feed on insects and small vertebrates. Green iguanas are able to convert the vegetation of tall trees to human food much more effectively than any other potential food species. Green iguanas require a rather precise ratio of two calcium to one phosphorus in their diet. Farmed iguanas can be fed a mixture of broken rice, meat meal, fish meal, various fruits and leaves and flowers although there is some debate as to whether feeding animal protein has long term deleterious effects on the iguana kidney.

Young iguanas take about 3 years to reach marketable size on a farm. Alternatively young stock can be reared to about 10 months and then released in trees nearby. If they are fed some supplementary food they tend to stay in the vicinity and can be harvested when they reach a suitable size. Tegu are generally carnivorous and will eat snails, insects, small mammals, smaller lizards including other tegus, various fruits, eggs of birds, turtles and caimans and occasionally carrion.

Health care

In the case of small animals there is a need to maintain and improve animal health as in large and medium–sized livestock production. Both public and private sector services will need to be involved in this operation.

Infectious diseases are a major constraint to livestock productivity and there is an urgent need to tackle the problem in order to improve and ensure food security. Diseases caused by viruses and bacteria are of major concern as they often cause serious epidemics which can severely disrupt both local and international trade. Parasitic diseases caused, amongst other organisms, by helminths and protozoa are also important because of their debilitating and often persistent effects. The first line of defence in the past has been chemotherapy which, although it may have initial spectacular results, may not prevent re-infection. Repeated treatment is expensive and time consuming and all too often leads to resistance to the drugs in the organisms being targeted.

Disease has direct repercussions through higher mortality rates and indirect ones through its effects on reduced reproductive performance and on slower growth rates. There is also the consideration of animal welfare: a contented and healthy animal will produce more high quality products in a shorter time than an unhappy and uncomfortable one. There is also a high risk that some diseases may be transmitted from

animals to man, this type of disease being known as a zoonose. The first line of defence in animal health care is thus prevention rather than cure. Small-scale farmers should work closely with their veterinary advisors and ensure that sanitation and biosecurity measures are of the highest order.

Some diseases affect a wide spectrum of host animals whereas others are more restricted in their effects to just a few or even a single species. It is not possible to describe or list every disease affecting small animals but some examples can be provided to illustrate the types of problems that may arise.

The main diseases of rabbits are myxomatosis, coccidiosis and pasteurellosis. Farmed rabbits can be protected against myxomatosis and calicivirus with a genetically modified vaccine but extreme care is needed to ensure that the vaccine does not escape into the wild. A possible human health issue associated with the use of rabbits for meat is Tularaemia or Rabbit Fever.

A risk associated with the eating of rat meat is contacting Weil's disease or leptospirosis. Rats are also notoriously associated with zoonotic diseases such as bubonic plague (of which there are still sporadic outbreaks in developing countries), Lassa fever and Hanta virus although normal health care should obviate these kinds of problems. Capybaras are known to carry foot and mouth disease and seem to be particularly susceptible to brucellosis as well as to mechanically transmitted *Trypanosoma evansi.*

Metabolic Bone Disease (MBD) in iguanas is caused by various factors including lack of calcium and inadequate exposure to ultra violet light. Metabolic Bone Disease (MBD) reduces the vitality of iguanas and can result in premature death. Green iguanas can carry salmonella which can be transmitted to handlers if sensible precautions are not observed.

■ *Sources of stock*

The sustainability of small animal production is in large part based on the availability of breeding and replacement stock. There is little problem in this context with rabbits and Guinea pigs which have been kept as domesticated animals over a very long period. The situation is somewhat different, however, with some rodents and reptiles which are relatively new activities. Many of the animals reared are initially captured in the wild. Activities based on wild harvest need to be linked to the ability of the natural environment

and its animal populations to recover and maintain their output. Factors that can affect the sustainability of this second type of small animal production include:

- rights of access to the resource including competing operations;
- resource availability;
- the intrinsic ability of the species to reproduce and multiply;
- temporal (seasonal and inter-annual) availability of the wild stock; and
- the potential for domestication and captive breeding.

Wild capture should, however, be considered only as an interim measure. Rearing small animals caught in the wild and then breeding them in captivity helps to protect the species while providing meat and income for small-scale farmers.

Labour needs

Small animal production on a small-scale is potentially accessible to most people. The cost of entry is usually fairly low and the major initial input is family labour. The intensity of labour use will clearly depend on the type of enterprise but at the primary production level labour use should not be excessive and work with small animals should not withdraw labour from other enterprises. Family labour resources are indeed likely to make better use of the added value of small animal production. Women and children in particular should have opportunities to acquire additional skills and become more involved in economic activity. This may have the effect of strengthening their position within the family and the local community.

Labour needs are more specialized and probably more intensive once individual and group processing are undertaken. Training needs for processing are more particular and more intensive than for simple production.

Indicative costs

The staple diet of many small animals is usually inexpensive. It largely comprises natural vegetation, fruit and vegetable wastes or rejects and harvest and household waste. This is a considerable advantage given the current rapidly rising prices and often limited availability of concentrate animal feeds which are in turn linked to the soaring cost of cereals and the limited output of petroleum products.

Other costs are associated with housing, health care and marketing but these, too, are not likely to prove excessive (see Case Study 5).

CASE STUDY 5 **Financial analysis of smallholder rabbit production in the Kumasi district of Ghana**

Data from nine backyard farms started and operated with family capital and labour were used for this case study. The farms had been in existence between two and six years at the time of the study. The animal population on the farms ranged from 91 to 223. Breeding does kindled (produced young) five times a year and produced an average of 21 fryers for the market. It was estimated that Ghanaian cedis ¢6725.37 (US$ 6052.83) was needed as initial capital for a 50-doe unit meat rabbit farm in Kumasi. The cost of housing (hutches) was 62.4 percent of the initial capital, equipment was 17.2 percent and breeding stock was 8.2 percent with 12.2 percent being needed for operating expenses during the first six months of operation (the period during which the farm could not generate enough money to pay for its running costs). A profitability index (PI) of 1.8 and an annualised rate of return (ARR) of 36.1 percent were calculated for the 5-litter a year breeding programme and the payback period was reached in the third year. A more intensive breeding programme of six litters per doe per year could have improved PI to 2.2 and ARR to 43.9 percent and this would have brought the payback period to the second year. It was concluded that a high return on investment and labour could be obtained if a family uses its own capital and labour to produce backyard meat rabbits and even more so if the doe could be managed to produce six litters in a year.

Source: Adapted from Karikari,P.K. & Asari,K. 2009. An economic analysis of a smallholder meat rabbit production system, Journal of Applied Sciences Research, 5(8), pp. 969-973

Nonetheless many smallholder farmers or other persons wishing to enter small animal production will have little spare income and few savings and will probably require a credit line to enter the business.

Strategies for successful and sustainable trade

Market appraisal

Smallholders need to be aware of the real and feasible opportunities for small animal production before they start an enterprise. At any level of commercialization it is the market that drives production. Investments for commercial production should be made only after it has been established that there is a guaranteed market for small animal products. Market appraisal requires farmers to investigate who the consumers are, what they desire, where they are, the price they are willing to pay, the cost of production, how products will be transported to market and the transport facilities available. Market appraisal helps smallholders and their groups or associations to learn about the activities needed to market their produce. Market appraisal can reduce considerably the risks inherent in making and taking the wrong production and marketing decisions.

The type of appraisal undertaken depends on the commercial objectives. If, for example, the objective is to supply a local market a simple investigation will establish which types of product are popular and what returns can be expected and whether these will cover the production costs and provide an adequate return on investment. If the objective is to produce for a larger (and probably more demanding) urban market, a more extensive appraisal process will be needed. This, of necessity, will involve higher costs and time as it may involve investigating such aspects as different product prices in various wholesale or retail outlets, the quantities that can be sold at each outlet, quality requirements (possibly including animal welfare considerations) and transport costs. Such an investigation may be beyond the capabilities of an individual farmer in terms of money and time but may well be undertaken by a group or association of farmers.

Consumers buy to obtain satisfaction so it is essential that the marketed produce be of good quality. Consumers vary according to age and gender and with cultural, ethnic and religious background and these characteristics and factors need to be taken into account in deciding what small animals to produce.

An early – or even an initial – step in production, therefore, is market appraisal. However, even though a market appraisal is a prerequisite for any commercial operation, it cannot guarantee success. Market appraisals can reduce risk and uncertainty in decisions about production and marketing, but cannot guarantee success.

Products: meat, fur, skins, eggs and breeding stock

Meat

Meat is the main product of most of the small animals discussed in this booklet. As for other types of animal meat, quality is affected by the treatment an animal receives throughout its life. More particularly, however, it is affected by the way the animal is handled in the lead up to and at slaughter. In order to avoid unnecessary stress and to reduce defects in meat related to stress, animals should be treated with care and consideration. The slaughter process itself should be carried out quickly and in as humane a manner as possible. Slaughtering and dressing techniques should be of the highest standards to conform to animal welfare and food safety considerations.

The domestic rabbit is a short life cycle animal and is regarded as an efficient producer of meat as a result of its fast growth rate and high fecundity. Rabbits are not as productive in protein and energy output per hectare as grain and potato crops but they produce more protein than pigs and more protein and energy than poultry (see FAO Diversification booklet No. 3 *Products and profit from poultry*) and sheep. Rabbit meat is of high nutritional value as it contains high quality protein, iron and phosphorus and a low amount of fat. The meat of domesticated rabbits tastes like chicken and is rather bland but this lends itself to being 'improved' with a variety of flavours. Rabbit meat is leaner than beef, pork and chicken. Rabbit products are generally labelled as Fryer (a young rabbit of 2.0 to 2.5 kg and up to 9 weeks old with tender and fine grained meat) or Roaster (over 2.5 kg and up to 8 months of age with firmer and coarser grained flesh that is less tender than a fryer).

Cane rats are widely distributed and are the most valued species of 'bush meat' in West and Central Africa. In Ghana up to half of all meat eaten is that of the cane rat. The meat is high in protein and low in fat and is greatly appreciated for its tenderness and taste. Other 'rats' are edible by

humans and are sometimes captured and eaten in emergency situations. In some cultures rats are considered a staple. Among the reasons why rat meat is not more widely eaten is the strong proscription against it in Halal and Kashrut tradition. Conversely, in the Mishmi culture of India rats are essential to the traditional diet as Mishmi women may eat no meat except fish, pork, wild birds and rats (see Case Study 6) . Bandicoot rats are an important food source among some peoples in Southeast Asia. Rice-field rats are a popular meat in parts of Southeast Asia and in Valencia in Spain *rata de marjal* was a main ingredient of the original paella (although now at least in part replaced by rabbit).

CASE STUDY 6 **Rats for food, livelihoods and the environment**

Vijay Prakash of the Bihar State welfare department told a press conference in Patna that "rat meat is a healthy alternative to rice and grains and should be eaten by one and all. Rat and chicken have equal food values not only in protein but throughout the entire spectrum of nutrition. I haven't tried it myself, but my mother has and she finds it delicious. In fact, whoever has eaten rat says it is more spongy and better than even chicken meat". Prakash went on to say that "almost 50 percent of India's grain stocks are eaten away by rodents in fields or warehouses. Increased human consumption of rodents will ease soaring food prices and provide increased employment for rat catchers. We will have a massive media campaign to persuade people to try it. Some hotels in Bihar have started selling rat meat as a starter. If you order patal-bageri at one of our roadside hotels, that's what you'll get. In Aizawl in Mizoram State in India smoked rat is a highly prized delicacy. The rodent is much in demand in kitchens in this Northeastern State. Hundreds of smoked rats come in to the city from nearby villages every morning. Rats caught by traps in paddy fields sell like the proverbial hot cakes." "I don't keep records of my sales but I normally sell about 200 smoked rats daily," a New Market shopkeeper told the Indo-Asian News Service. "They don't come cheap either with one smoked rat costing Rupees 15-20."

In late 2008 Reuters reported that the price of rat meat had quadrupled in Cambodia creating hardship for the poor who could no longer afford it. Cambodia also exports about a tonne of rats daily to Viet Nam as food. The rise in price has encouraged a return to rat catching and children are entering the labour market for rat catchers and are offering rat meat in the local markets.

As an alternative form of protein rat meat is "low in fat, low in food miles and completely free range". In fact, some claim that " rat meat is about as ethical a dish as it is possible to serve on a dinner plate."

Source: Adapted from Food and Wine. 2009. The ubiquitous rat, by P.Brunning, International Wine & Food Society Europe & Africa Committee - issue 98

CASE STUDY 7 **Rodent trade in Oxchuc, Chipas, Mexico**

In Mexico alone, around 100 wild mammal species have known uses by local communities (Lopez-Wilchis *et al.*, 1992; Naranjo *et al*., 2004; Uribe & Arita 1998). In spite of the fact that small rodent species represent a significant part of mammalian diversity (Ceballos *et al.*, 2002), the recorded use of rodents in Mexico has focused on large and medium-sized species (Guerra 2001; Jorgenson 2000; Naranjo 2002). However, there is evidence of the use of small rodents as sources of food, medicine and ritual objects (i.e., Neotoma albigula, Sigmodon hispidus, and some pocket gopher species) in the highlands of central Mexico (Mellink *et al.*, 1986).

In this regard a study in the town of Santo Tomas Oxchuc, in the highlands of Chiapas, Mexico, was conducted. The number of individuals per rodent species traded as well as the biomass, sex, presentation (raw, cooked), and price of each rodent offered by the salesman was recorded. Rodents were sold as food either raw with skin or cooked. Fifty-three percent of all rodents sold were small-sized (<100 g), and most of them (73.1 percent) were sold cooked. The most frequently traded species were *Neotoma mexicana*, *Peromyscus zarhychus*, *Ototylomys phyllotis*, *P. mexicanus*, and *P. aztecus*. Small, cooked rodents were more frequently sold than large, raw ones and there was a significant increase in rodent sales in the rainy season (particularly July and August) in comparison with the dry season. Among the three most traded rodent species in Oxchuc, the Mexican wood rat (*N. mexicana*) was the most frequently sold. The other two species were the hispid pocket gopher (*Orthogeomys hispidus*) and the Chiapan deer mouse (*P. zarhychus*).

Meat samples obtained from rodents for sale in Oxchuc had a high protein content (78.3 percent), as well as a high percentage (86.06 percent) of total digestibility. At the same time, rodent meat was low in crude fiber (0.93 percent), as well as in fat and non-nitrogenated components.

For local inhabitants, such mammals constitute a valuable natural resource producing economic and nutritional benefits. However, uncontrolled rodent exploitation may also have negative effects on some wild populations, such as those of P. zarhynchus, a species endemic to the Chiapas highlands. The rodent demand in Oxchuc is higher for sets of small, cooked mice (*Peromycus aztecus, P. levipes,* and *P. mexicanus*) than for large, raw species (*N. mexicana, O. hispidus*). The sale of cooked rodents allows traders to keep their products in good condition for a longer period, facilitating transportation from remote communities. The Mexican wood rat *(N. mexicana*) was the species most frequently traded raw and skinned. These large-sized rats are preferred by local consumers probably because they supply more meat per kilogram than smaller species.

The rodent trade generated an estimated income of Pesos 51 841 as recorded in the 10 month study period. The total amount of raw rodents sold generated an income of Pesos 22 051, while cooked rodents produced an income of Pesos 29 790. The average cost of a raw, small-sized mouse (around 100 g) was between Pesos 2.50

CASE STUDY 7 **Rodent trade in Oxchuc, Chipas, Mexico** *(Cont.)*

and 5.00. Large-sized rats and pocket gophers (>100 g) were sold at Pesos 10–30 each. The three rodent species that generated most income for Oxchuc traders were *O. hispidus* (Pesos 10 655), *N. mexicana* (Pesos 7 125), and *P. zarhynchus* (Pesos 1 761).

Source: Adapted from Barragán, F., Reetana, O.G. & Narnjo, E.J. 2007. The rodent trade of Tzeltal Indians of Oxchuc, Chipas, Mexico, Journal of Human Ecology, 35, pp.769-773

Capybara meat, which tastes rather like pork and is of a similar colour, is traditionally cooked in many ways by boiling, frying, grilling and roasting but most is eaten in the dried and salted form. Traditionally this delicacy is served with rice and plantains. The fresh carcass dresses out at about 52 percent but this is reduced to about 17 percent of the initial live weight in the dried form.

The flesh of turtles has long been considered a delicacy in many cultures. Turtle soup has been a prized dish in Anglo-American cuisine and remains so in parts of the Far East. Turtles remain a part of the traditional diet on the Grand Cayman Island in the Caribbean, so much so that when wild stocks became depleted a turtle farm was established specifically to raise them for their meat (see Case Study 8). The farm also releases specimens to the wild as part of an effort to repopulate the Caribbean sea. Fat from turtles is also used in the Caribbean and in Mexico as a main ingredient in cosmetics marketed under its Spanish name of '*Crema de Tortuga*'.

CASE STUDY 8 **Grand Cayman Turtle Farm**

The Cayman Islands government has set about conserving the green sea turtle in a big way. The Grand Cayman Turtle Farm at Boatswain's Bay is one of the ways they do it. Conservation plays a big part in the effort to save the turtles and this facility sets out to redress the supply part of the problem. Feeding is easy as visitors (adults pay a US$60 entrance fee and it costs US$25 for children aged 2-12) happily buy a bag of feed at the door and sprinkle it on the water (these are the world's best fed turtles!).

Turtles mate, lay their eggs and hatch their young in safety unmolested by people or predators. Unmolested in the worst sense they may be but not entirely free from

CASE STUDY 8 **Grand Cayman Turtle Farm** *(Cont.)*

human interaction as baby turtles are subject to daily indignity as they are picked up and fondled by adoring visitors. The turtles seem to thrive on this treatment as they grow to a good size. A proportion of the turtles is killed for sale as meat but the majority is released into the sea to live among the reefs and wrecks around Grand Cayman. The Boatswain's Bay farm also supports two other endangered turtle species, the hawksbill and Kemp's ridley turtle which is the world's most endangered sea turtle.

Source: Adapted from Grand Cayman Wonderer. 2009. Cuddle baby turtles at the Grand Cayman turtle farm (Available at http://www.grand-cayman-wanderer.com/grand-cayman-turtle-farm.html)

Fur and skins

In addition to meat many small animals produce fur and skins as a primary or secondary product. Fur can be harvested from some live animals several times over a lifetime as well as being an end product at slaughter. Prime quality products require prime quality treatment. Correct treatment of live harvested fur and correct after slaughter treatment of fur and skins should adhere to standard practices. Flaying of skins should be carried out carefully to avoid cuts and other defects. Cleanliness – avoiding contact with blood and faeces for example – is an important consideration for ensuring that the end product is of the finest quality. Correct initial storage is also important and products should be kept free of insects and other vermin. Cool storage will slow down the growth of micro-organisms that can damage or cause defects in fur and skins and will help to ensure a quality product (see FAO Diversification Booklet No.8 *Higher value addition through hides and skins*).

Angora 'wool', pelts and skins are produced by rabbits in addition to meat although meat production is by far the largest output from rabbits in general. Angora wool occupies a special position in the world textile trade (see Figure 12). The People's Republic of China is by far the largest producer of Angora wool at about 2 000 tonnes per year. Argentina, the Republic of Korea and India also produce small amounts of Angora wool. There is a very small Angora rabbit wool industry in Bolivia where yields of 100-150 g fibre are produced every 70 days with the product being sold for export. Rabbit

FIGURE 12 Angora rabbits at the Technical University, Oruro, Bolivia (Photo by R. T. Wilson)

pelts – the skin with the hair attached – are used for clothing but mainly for accessory items such as scarves or hats. Rabbit skins are normally used for small items of clothing but it should be noted that the best quality skins derive from the middle level of husbandry as the skins of the fastest growing rabbits are thin and do not work well (see Box 3).

International trade in chinchilla fur goes back to the sixteenth century. The fur is popular in the speciality trade as a result of the extreme softness of its feel which arises from the 60 or so hairs that sprout from each hair follicle. Since the 1950s several colour varieties of chinchilla have been developed including white, beige, violet, black velvet and sapphire. These colours are controlled by recessive genes. The colour is usually very even which makes it ideal for small garments or the lining of large garments though some large garments are made entirely of chinchilla. A single full length coat made from chinchilla fur may require as many as 150 pelts and at current prices might cost US$100 000.

Capybara skin is tough and hard wearing and produces a very high quality and much esteemed

leather. At least one outlet in the United Kingdom produces trouser belts from capybara leather which it describes as "Gaucho belts of the ultimate in luxury leather, similar to velvety smooth suede with a unique tooled finish". There are also luxury leather outlets for capybara in Argentina. Capybaras produce some of the best leather for glove making. Known as carpincho leather ('carpincho' is the vernacular name of the capybara in Argentina, Uruguay, Paraguay and southern Brazil) it commands a very high price on world markets because it is heat resistant and stretches in only one direction allowing gloves to stretch sideways but not lengthways and thus becoming loose.

BOX 3 **Rabbit pelts and skins**

Production of quality fur pelts is not compatible with intensive meat rabbit production techniques. Rabbits are often slaughtered at an age or in temperate regions at a time of year when their coats have not fully developed. Slaughter at 10 to 12 weeks means rabbits still have an infant coat or are beginning the subadult moult. These thin and unstable coats are not suitable for furs. The only season when the adult (age older than 5 months) coat is stable and homogenous is winter. At other times moult areas of greater or lesser size mean the coat is uneven and the hair is not firmly attached to the skin. Some summer coats can, however, be homogenous especially those of rabbits that have completed the subadult moult but the coat is thinner than the winter coat. This rather inflexible growth cycle and seasonal changes in the coat create the problem of simultaneous fur and meat production. Fur is therefore only a by-product in intensive production.

No research has been done on moulting patterns in hot climates but in extensive production systems rabbits are slaughtered at 4-6 months. Quality skins could thus be produced in the tropics if proper skinning and preserving techniques are used.

In an unsorted batch of rabbit skins valuable pelts can be found side together with useless waste. Sorting and grading should be done as early as possible. Sorting is the first operation and determines the future use of the skin. Skins are sorted into three grades:

- pelts for dressing (the term 'dressing' instead of 'tanning' is used for fur) are the best (flawless) skins with regular shape and an intact, homogenous, dense and well formed coat;
- pelts for shorn hair usually lack the proper shape or are not homogenous enough for fur products but the hair is sufficiently long and healthy – they are shorn by machine and used for textiles or felting (though the millinery trade is declining in many countries) and the skin is then cut into fine strips (vermicelli) and made into glue (another declining industry) or fertilizer.

BOX 3 **Rabbit pelts and skins** *(Cont.)*

- waste skins are unusable except for fertilizer with the hair being gnawed, cut, soiled, sweaty and parasite-ridden.

The price of pelts for dressing may be 20 times that of ordinary-quality skins. These last increase the costs of labour, processing and transport.

There are three types of juvenile coat: that of the newborn rabbit, infant coats and subadult coats. The first two are so small as to be unusable. The coat of the newborn rabbit stops growing when the animal reaches 0.4 kg (for an average size breed); it weighs only 8 to 10 g. The subadult coat is produced usually after 5 months of age after a long (4 to 5 weeks) moult and only begins when the rabbit reaches 1.7 to 1.9 kg. The weight of the coat, and hence the length of the hair and its density, depends on the season in which the hair develops and is about 40 g in summer and 60 g in autumn or in winter. It is very difficult to obtain pelts for fur in intensive production systems (slaughter at 11 weeks) but a breeder might attempt to produce acceptable pelts for shorn hair by using simple measures (animal housing, precautions at slaughter and skinning). It is possible to produce pelts for fur in an extensive production system in which production techniques are strictly adhered to, especially with regard to hygiene, habitat and feeding.

Source: FAO.2006.Technology for agriculture : proven technologies for smallholders. Rabbit: Skin, slaughtering and production of quality pelts (Available at http://www.fao.org/teca/content/rabbit-skin-slaughtering-and-production-quality-pelts)

International trade in reptile skins derives mostly from five species. These are the American alligator, Nile monitor, black and white tegu, reticulated python and red tegu. The presence of the two tegu species and the Nile monitor in this list is encouraging for small animal production as they are similar to or slightly smaller in size than the green iguana whose skin could almost certainly compete in the same market. Reptile skin products are very varied but mostly comprise shoes (see Figure 13), handbags (see Figure 14), garments, luggage, briefcases, wallets, belts, watchstraps and other small leather goods.

Eggs

Green sea turtles, as well as other species, have been commercially harvested for eggs and food for centuries. Illegal collecting continues but many are now bred in captivity (see Figure 15). Reptile eggs are little used in European and North American cookery but are prized by Arabs and Indians. There is a potential market

FIGURE 13 Industrial 'Western' boots made of reptile skin in the United States of America
(Photo by R.T. Wilson)

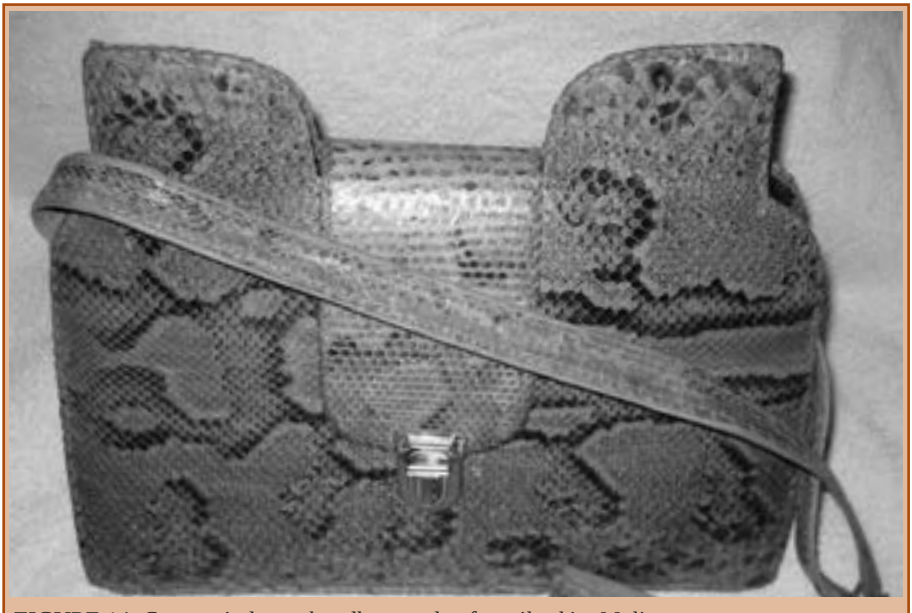

FIGURE 14 Cottage industry handbag made of reptile skin, Mali
(Photo by R.T. Wilson)

FIGURE 15 Captive bred green pacific turtle, Guayaquil, Ecuador
(Photo by R.T. Wilson)

for reptile eggs from captive bred or farmed animals.

Breeding stock

The production of breeding stock – animals that are not reared simply to produce meat, fur, skins or other end products but are destined to be used to provide a pool of animals, often of superior genetic merit – offers possibly the most lucrative return to farmers engaged in small animal production. Breeding stock of all species is valuable but is particularly so for the small animal species which are endangered in the wild and against which there are international proscriptions on capture or hunting. Thus the best possibilities for breeding stock include chinchilla, turtles and iguanas.

Smallholders who specialise in producing breeding stock are almost certainly amongst the most efficient and knowledgeable members of the small animal farming fraternity. They will have

a deep if not necessarily formal or 'book-learned' understanding of the genetic merit of their stock and their intrinsic worth in terms of improving the animal stock in general and in their financial value.

Other uses

Rabbits are very good producers of manure and as their urine is high in nitrogen it makes a good specialist fertilizer. Rabbit milk is sometimes considered to be of great medicinal and nutritional benefit as a result of its high protein content.

A dictionary definition of Guinea pig is "something used as a subject of scientific research, experimentation or testing". Many rodent species and other small animals are indeed used, often controversially, as 'animal models' for medical and veterinary research and, perhaps even more controversially, for research into the effects of cosmetics. Other rodents are now being used in areas of armed conflict as sniffer animals to detect land mines and other explosive devices.

Up to four litres of oil can be obtained from the subcutaneous fat of a capybara in good body condition. This oil is considered an excellent cure for asthma in Argentina, Brazil and Uruguay.

Turtle plastrons (the part of the shell that covers a tortoise from the bottom) together with other animals parts and plants are used in traditional Chinese medicine. Taiwan still imports hundreds of tonnes every year. A popular medicinal preparation based on powdered turtle plastron and a variety of herbs is Guilinggao jelly although nowadays it is typically made with only herbal ingredients. Efforts are being made in the People's Republic of China to satisfy the increasing demand for turtle meat as gourmet food and traditional medicine to rear turtles on farms, of which there were more than one thousand in the People's Republic of China in 2007. Turtle farms in Oklahoma and Louisiana in the United States of America also rear turtles for export to the People's Republic of China.

Adding value

Value can be added to the primary product – be it meat, fur, skin or other commodity – by preserving or transforming it or directing it at a speciality market. In this context many small animals already have added value as in many areas and for many societies they are considered authentic delicacies and highly appreciated by gourmets

according to local and traditional eating habits. Of the types of small animal that are the subject of this booklet, species which fall in to this category are grasscutters in Western and Central Africa, Guinea pigs in the Andean countries, capybara in the flooded areas of South America and green iguanas in Central America. In their own areas of distribution but often also further a field these are excellent examples of highly valued and choice foods.

Preservation and transformation of the base product, often referred to simply as processing, is carried out for a number of reasons. It can be considered as a form of storage that enables perishable goods to be kept over a longer time. It can allow smallholders to sell their produce not only at harvest (slaughter or shearing of fur) but over a much longer period. Processing also creates differentiated products, moving them from being a mere commodity to the higher standard of a product. It further leads to less dependence on a few items for marketing, a greater product portfolio, value added products and the possibility of obtaining higher returns.

Before considering setting up a processing business several issues need to be assessed. These include the:

- quantitative demand for processed products;
- market demand in terms of price and quality;
- base products available for processing in terms of quality and quantity;
- tools and equipment available and required for processing;
- cost of tools and equipment and their maintenance and spare parts needs;
- needs for raw materials (salt, other chemicals and preservatives, water) for the processing operation;
- hygiene and food safety measures that need to be observed;
- skills that are needed for the processing operation and if training is needed; and
- capital and recurrent processing costs and if finance is available or can be obtained through credit.

The advantages accruing to processing include:

- delayed or phased consumption of the primary product;
- improved household nutrition;

- longer storage periods or shelf-life;
- easier storage and often occupying less space;
- reduced post-harvest and storage losses;
- wider range of marketing options; and
- possibilities of better labelling and 'branding'.

Processing may also be accompanied by some disadvantages including:

- competition from large-scale commercial processors who may be able to sell processed goods at a lower price; and
- high costs associated with setting up and operating a processing operation.

Processing is probably best undertaken as a group or cooperative activity. This will involve sharing of costs, a greater quantity of quality produce being manufactured, consistency of quality and the probability of a better bargaining position with merchants, middlemen, wholesalers and retailers. An associative enterprise however does require good cooperation among producers, appropriate management and effective and efficient marketing.

Some examples of processed or transformed products that add value to the basic 'commodity' can illustrate the possibilities of small animal production. In South America capybara meat has been used to make several types of sausage. Value can be added to most meats (and their shelf-life extended) by drying, salting, smoking, shredding and by the addition of some seasoning. The last is especially useful for the blander meats such as rabbit. Value can be added to hides and skins by taking them beyond the simple drying process and, for example, doing some tanning.

As already indicated, supplying such niche markets as the Fair Trade movement and the organic consumer can create considerable additional value. A possible source of added value in the future or where there is already a high degree of control is that of Protected Geographical Status (PGS) and its derivatives including Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) or Traditional Speciality Guaranteed (TSG) (see Box 4).

BOX 4 Geographical indications and traditional specialities

Private, national and regional certification schemes for agricultural products and foodstuffs provide assurance that aspects of the product or its production method, as laid down in a specification, have been observed. They cover a wide range of initiatives that function at different stages of the food supply chain. They can operate at business-to-business (B2B) level or at business-to-consumer (B2C) level. They can make use of logos but especially at the B2B-level many do not. Certification schemes in the European Union range from compliance with compulsory production standards to additional requirements relating to environmental protection, animal welfare, taste qualities and 'Fair Trade'. Scheme owners are equally varied and cover the whole range from farmers and producers, through NGOs, interest groups and retailers to public authorities. Three European Union schemes known as (Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and Traditional Speciality Guaranteed (TSG)) promote and protect names of quality agricultural products and foodstuffs. These schemes encourage diverse agricultural production, protect product names from misuse and imitation and help consumers by giving them information concerning the specific character of the products.

- PDO covers agricultural products and foodstuffs which are produced, processed and prepared in a given geographical area using recognised know-how.
- PGI covers agricultural products and foodstuffs closely linked to a geographical area and at least one of the stages of production, processing or preparation must take place there.
- TSG highlights the traditional character of a product either in its composition or its means of production

To register a product name a group of producers (in the EU in the case of the EU) must define the product according to precise specifications. It then sends an application for registration and recognition to its national authority. Producers outside the EU can either complete an application form that is available on line and send it to the European Commission via their national authority.

Source: Adapted from European Commission.2011. Geographical indications and traditional specialties (Available at http://ec.europa.eu/agriculture/quality/schemes/index_en.htm)

Marketing channels

Marketing involves operations and tasks that enable a farmer to sell farm produce. Sales can be 'direct' to a market or 'indirect' through local traders, middlemen, processors, wholesalers and retailers. Small animal produce can be aimed directly at final consumer markets such as local village markets (see Figure 16) or at business markets where products

FIGURE 16 Dried and smoked grasscutter carcasses at local market, Lomé, Togo (Photo by R. T. Wilson)

are bought for further use or for selling to another intermediate or final market.

In extended marketing channels investment will be needed in market sheds, collection points, cold storage facilities and, possibly, in laboratories for testing produce. Buildings and good road access provide the security and capability that allow people to produce, transform, exchange and consume goods. Smallholder producers in remote areas often lack access to markets because roads and transport facilities are poor or possibly non existent. Many of the physical assets needed to undertake small animal production are not exclusive to that enterprise but help to meet general livelihood needs. These may include a transport and communications infrastructure, clean water, energy and buildings for shelter and storage. The more developed the infrastructure the easier will be the establishment and undertaking of the activities required by the enterprise. Information on the physical infrastructure including the transport network and its related costs and the availability of energy are needed to evaluate the potential to move a product along the marketing chain.

Physical communication networks are also important for transmitting messages along the supply chain, either in the form of prices for quality and quantity or descriptions of how a product should be presented or processed. It is important to consider a variety of factors at collection sites and the first points of trade within and outside the community as these may be key determinants of a successful marketing strategy.

The supply chain for the trade in reptile skins is an example of an integrated marketing channel. The chain varies from species to species and country to country but the general flow is from hunters/farmers who sell skins to tanneries either directly or via middlemen who then resell to the tanneries. The tanneries are sometimes located in the country of harvest although the biggest ones are more usually located in developed countries such as France, Italy or Singapore. These tanneries transform the raw or cured skins into leather that is then bought by manufacturers who turn it into goods. In the final step retailers sell the leather products to consumers.

Marketing strategies

In small-scale commercial production the potential opportunities should be identified with probable customers. The market appraisal already described can be very helpful to small holders in guiding decision-making for production and marketing. In planning production, for example, it can provide guidance on what to produce, when to produce it, how much to produce and how much it will cost. In planning marketing it can provide information on what quantities are required, where products can be sold, when they can be sold, to whom they can be sold and the price at which they can be sold. Marketing does not, therefore, and as most people think, only take place at slaughter time. It starts when the farmer chooses the small animal and the products that will derive from it and commences breeding and rearing operations. This is because all production must be directed at what the market needs and wants. In marketing terms it is a very good strategy to have sold the output or at least identified the probable outlet before it has been produced.

A major challenge to small animal production is to create a market niche for the product. This may involve overcoming consumer reluctance to try a product from an unfamiliar animal. Even in very affluent areas, health concerns about the high fat content of highly

domesticated animal protein are adding to consumer interest in alternate protein sources.

Rewards that accrue from successful commercial production and marketing depend on the skills of the farmer and the particular market or markets being targeted. In near subsistence production the level of skill is unlikely to be high and productivity is low. In this situation it is also unlikely that the consumer can afford a high price. As production becomes more commercialized the skills required and the levels of investment increase. The potential rewards are greater in terms of higher yields and better quality but the level of risk also increases. Post-slaughter and marketing methods become relevant since markets may be a considerable distance from the place of production. Producers must therefore familiarize themselves with improved post-slaughter and marketing skills.

Grades and standards become increasingly important with the development of high value markets. Standards can be set by private companies, trader associations or public bodies but when common standards are absent the public sector is required to develop them. Once standards have been set the public sector can also encourage their widespread adoption by providing information, training, arbitration services and infrastructure. Production for an overseas export market has the potential for excellent rewards but production, processing and packaging standards must be commensurately high.

Farming to a contract may be a useful marketing strategy. Contract farming can be defined as production carried out according to a prior agreement under which the farmer commits to producing a given product of a given quality in a given manner and the buyer commits to purchasing it. This is now a common practice in Europe whereby the major retail chains enter into contracts with intermediate processors and primary producers (although the system is far from perfect and sometimes subject to abuse). In many cases the buyer provides the farmer with technical advice, breeding or growing stock, feed and other inputs on credit and offers a guaranteed price for the output. Proponents of contract farming argue that it links small-scale farmers to lucrative markets and reduces the constraints they face in diversifying into high value commodities and connecting to markets. Contract production is not appropriate to all commodities but it can be useful in making the

production of high value product for a quality sensitive market viable for small-scale farmers.

New and unusual market areas can be sought and can prove to be very lucrative once they have been 'captured'. There are, for example, huge markets for turtle meat not only in mainland People's Republic of China and Taiwan but also in Mexico (nearly 32 million turtles were exported from the United States of America to these countries in the 3-year period 2002 and 2005). Worldwide there is also a large demand for turtles as pets.

Support services to promote small animals

Technical support

Training technical staff and producers in small animal production, slaughtering and appropriate practices in processing is a challenge but the economic, social and environmental benefits are such that it is undoubtedly worth the effort (see Case Study 9).

Many societies have considerable traditional knowledge and skills in regard to the production, management, slaughtering/ harvesting, processing and use of their farm products. They also have knowledge of the location and identity of local or regional markets and traders. Development projects that recognize these skills and build on them in order to provide more income and to ensure that the enterprises are sustainable have a greater probability of success.

The set of skills required, however, greatly depends on the level and scale of the activities that are undertaken or envisaged. As activities develop to an extent that they require more sophisticated processing and as trade moves from local to regional, national or even international the skills, resources and entrepreneurial expertise required also increase. It is therefore essential that the capacity available for resource management, production, processing, and product promotion and marketing is assessed. Where these need improving their development should be facilitated to encourage and promote the transition from subsistence into trade or to expand existing trade.

Information on human resource capacity can be used to evaluate existing levels of technical skills and experience in production, processing and marketing, and can help identify potential interventions. Other required skills include the ability to interpret market information. Some areas of expertise that could have an influence on whether or not small animal activities are successful include:

- knowledge of the impact of pests and diseases on final output at all stages of the production cycle;
- impact of welfare and slaughter and processing techniques on product quality;
- experience of various marketing strategies; and

- understanding the links between variation in quality of the product and the final price.

A common constraint in small animal production and marketing skills is the lack of appropriately trained extension staff. Training of trainers can educate local extension staff, who then in turn train small-scale farmers and others in the small animal supply chain. In the particular case of small–scale farmers small animal Farmer Field Schools (FFSs) can be organized. The objective of FFSs is to develop local small-scale farmer capacity with an intent off getting them to analyse their production practices and systems, find the problems involved, test possible solutions and as a consequence adapt the most suitable farming practises.

The FFS approach is based on a 'learning-by–doing' approach where farmers learn directly in the 'field' working with small animals and each activity that they carry out involves action, observations, analysis and then taking a decision. The aspects considered do not only focus on the 'how' but importantly on the 'why'. Further information on FFSs for livestock can be found in the *Selected further reading* section of this booklet.

CASE STUDY 9 **Training at Joyce-Giwu grasscutter farm, Ghana**

Ghana imports 80 percent of the estimated yearly national meat requirement of 200 000 metric tonnes. This figure suggests that there is the need to develop other sources of acceptable meat in addition to conventional livestock. Grasscutter meat is a delicacy in Ghana because of its high protein contents and low cholesterol level as compared to beef and goat meat.

The Joyce-Giwu grasscutter farm obtained approval by the Ministry of Food and Agriculture as a model training centre for grasscutter production and marketing. Prospective grasscutter farmers (youth, unemployed, pensioners, single parents, students, workers, school dropouts) are trained in production matters. Training for workers lasts about three days and for non-workers last five days. Training sessions are both theoretical and importantly practical. Specialist courses, such as farm management and dealing with banks, are also organized. At the end of the course prospective farmers can be provided with genetically improved breeds of grasscutters and cages. Novice farmers are mentored for one year for monitoring purposes, so as to ensure that they practice good grasscutter husbandry and refresher courses are organized. Encouragement is also given to form grasscutter farmers' associations.

Source: Adapted from Ministry of Agriculture and Food, Ghana, training centres website, Joyce-Giwu grasscutter farms. (Available at http://www.mofa.gov.gh/training_centres.html)

Business, marketing and entrepreneurial skills training

As with many farm enterprises a wide range of skills are required and these are not only technical. Business and marketing skills required may at first sight appear to be simple but in many cases they are only acquired by experience and learning by doing. In successful small animal production, sound technical knowledge must be linked to good business and marketing skills.

Specific needs for training in entrepreneurial, business and marketing skills include:

- training in farm business management;
- training in marketing;
- training in entrepreneurship;
- linking farmers to markets: supply chain and networks;
- value adding though training in processing;
- encouraging and supporting cooperation among producers, processors and purchasers.

Market information

A major reason for marketing margins in developing countries being high is that primary producers have little information about current prices in nearby markets. Many local traders have incomplete information about market conditions. If farmers were better informed about prices and trends they would be in a much better bargaining position and would be able to obtain higher prices from traders. If traders were better informed, trading would be less risky and they would be able to reduce their 'risk premium'. Both government and farmer organizations can play a useful role in collecting and disseminating prices and other important marketing information. Moreover training and support to small-scale farmers on how to use such information is also important.

Producers, processors and traders can gain access to market information through good organization. This will include contacts with traders, knowledge of additional sales outlets and information on market trends. Market information should relate to the quantity, quality and price of various products in various markets. It is essential when attempting to enter new markets and in ensuring that market share is maintained. Whereas information is essential, information alone is not sufficient as producers need to have the capacity to act upon it. Market information – or the lack of it – is less of a barrier for short supply chains where generally ungraded and raw produce is sold at a local or regional level. Information

becomes more important for trade in processed or graded products that sell at different prices.

Supply chains are very vulnerable where markets are concentrated in a monopoly or near monopoly of information. Producers usually live and work in remote areas and middlemen are often the only source of information between producers and markets. Community organizations can allow producers to offer sufficient produce to interest new traders or to negotiate improved relations with existing traders.

Small-scale farmers as well as others involved in small animal supply chains can be supported in establishing links and contacts not only with marketing information, but with the promotion and support in formal organizations such as producer and marketing organizations for small-scale farmers, trader organizations, commodity associations, etc.

Organizational options: producer groups

Individual producers, traders and retailers have small voices that are often not heard nor listened to. The formation of groups can contribute to greater empowerment through making those voices stronger as well as speaking as one. Groups can be formal or informal. A regular characteristic, however, is help and support from families and friends. Groups strengthen the individual. They allow access to the broader society and to information of various kinds. Social assets such as networks and producer and marketing associations can be extremely important in the success of small enterprises involving small animals. Local associations should be able to provide marketing support (including dissemination of marketing information) and legal and policy advice. They should also be able to organize collectors and traders to increase their market power. A further function of groups is to provide or facilitate access to credit.

Organizations of smallholder farmers bring many benefits and have many advantages. They are set up to serve the interests of the members and to be directed and managed by them although in some cases professional staff may be hired to manage an association. Service provision is driven by members' and market needs. Associations provide a forum where all members have equal rights and can voice their concerns. The formation of associations among smallholder farmers enables donor sponsored projects to be delivered in

a far more cost effective manner and training can be more easily provided. Other advantages include the sharing of knowledge, for example, the best species and breed characteristics for a particular enterprise and the type and kind of feed that is best for the enterprise and where it can be obtained. The sharing of risk is another advantage as are the ability to reduce the costs of feed, and of veterinary services.

Associations not only provide an effective means for self-realization and capacity building of their members but also have important spill over effects within the wider community. Associations can also increase rural mobility and create a demand for associated services and also generate employment opportunities, strengthen the democratic process and encourage dialogue in the local community.

Creation of and participation in networks through government, non-governmental organizations (NGOs) and the private sector can in turn lead to more formal and intimate contact with regional, national and international partners, identify and provide or find sources of training, identify new markets and improve understanding of the industry. Cultural, social and organizational issues are important in determining the direct and indirect benefits of small animal production for various social groups and between men and women (see Figure 17).

FIGURE 17 Woman member of Angora rabbit producer group, Simao, the People's Republic of China
(Photo by R T. Wilson)

A transparent legal basis is required for participatory organizations in order for them to be able to conduct business development on their behalf and for the benefit of their members. Establishing an association is often complex and expensive in many countries. In such countries there is a clear need to review and, if necessary, revise the legislation related to the promotion of market-oriented development by smallholder farmers. Existing legislation is often a hindrance rather than a help to the development of farmers' associations and to their business activities.

Financial services

Lack of or difficulty in obtaining financial services is often a major limiting factor for smallholder farmers. This is especially a problem as they begin their move from subsistence to market oriented activities. Access to credit is one of many conditions for investment in improved production methods and systems. Government services have been used in the past to provide smallholders with credit but they have rarely been effective. A sustainable credit scheme needs to be linked to existing or new banking systems. Financial institutions need to develop credit services that can be used by smallholders in the context of the local production system as well as being profitable for the institutions themselves. Smallholders need to upgrade their financial management skills, including business planning, understanding of cashflow and simple bookkeeping.

Credit may be necessary not only for individuals but also for producer and marketing associations. Finance is needed for collection centres, for quality control and product grading and to bulk up supply to a level where traders will purchase it. Access to credit could enable small-scale farmers to increase their income through higher volumes that can be sold at remunerative prices. Longer term loans are needed for investments in animals and equipment but access to such financial services is often problematic for those who live in rural and remote areas especially because, in most cases, they lack adequate collateral.

Savings programmes should be developed in parallel with a credit scheme as it has been shown that it is the savings option that is initially used in preference to the borrowing one. Savings facilities help households to build up assets over time that can be used for investment,

consumption and to mitigate effects of unforeseen events and risk. For a credit scheme to be sustainable, however, it is important to ensure that, in addition to access to markets, beneficiary households also have sufficient labour, knowledge, skills and access to feed and are able to provide adequate care for animals.

Information on financial capacity can be used to determine the extent to which individuals and communities are integrated into the cash economy, have access to different forms of financial services and have an effective demand for investment capital. On a family or individual basis there are likely to be differences in access to credit and other financial facilities from both socioeconomic and gender status points of view. Factors which may influence whether or not small animal production activities are successful include:

- speed and rate at which money and time invested in production activities are returned;
- compatibility between income generating and subsistence activities;
- the availability of investment capital and access to external financial services such as credit and loans at reasonable interest rates and;
- the willingness of entrepreneurs to invest in key components of the marketing chain.

Veterinary services

Both preventive and curative veterinary services are required for small animal production. Concurrently these services should be provided by both the public and private sectors in cooperation rather than in competition.

The public sector has a role on regulation, preventive veterinary services, food safety standards, research, laboratory work and some aspects of training. The private sector should be mainly if not entirely responsible for clinical veterinary services and also for some aspects of training. Clinical services can be supplied by fully qualified veterinarians, by veterinary assistants or by community animal health workers or para-veterinarians (see Case Study 10). This three tier system can be very effective in reducing costs of health care, making them more affordable to all and bringing health care closer to the community, especially if private veterinary pharmacies are also set up (see Figure 18).

CASE STUDY 10 **Community animal health workers**

MacDonald lives in Nzeluni village near Mwingi in the Eastern province of Kenya. Trained as a community animal health worker by FARM-Africa, he was given a drug kit, bicycle and mobile phone. He treats and gives advice on animal health to local farmers in his community and these days his business is thriving. He has almost 80 clients and earns around Kenyan Shillings TSh3 000 (US$231) a month. Not only is he now able to get his basic needs met but he can also afford to build himself and his new wife a larger house as well as employ someone else on his farm.

Since his training, he now helps people in his community with managing their poultry, cows and goats. Joyce Mwanziu, a member of his community, says "what I have learnt from MacDonald is a preventative approach -- as a result my animals can fetch a better price in the market if they are in better condition". According to Dr. James Kithuka, FARM-Africa, Mwingi, "the level of awareness of animal health in farmers is rising -- they are seeking more advice -- and that must translate into more healthy animals".

Community animal health workers are trained by FARM-Africa in basic animal healthcare to be able to deliver services and drugs to farmers and to provide farmer to farmer training. "A decentralised vaccination and animal health system is important as this enables the community to take care of their own livestock, look for drugs, have their own drug stores and treat the animals themselves" says Dr Joseph Wekundah, Livestock Specialist, BioTechnology Trust Africa.

FARM-Africa has pioneered a 'three-tier' animal health system in Eastern Africa and demonstrated that it is financially viable and capable of delivering quality and affordable animal health services even to poor livestock keepers in remote areas. There is a vet at the top, several veterinary paraprofessionals (animal health assistants) in the middle who have usually received two to three years formal training, and a number of Community-based Animal Health Workers (CAHWs) at the grassroots level who have a few weeks basic training. According to Dr. Christie Peacock, CEO FARM-Africa, "there is great potential to replicate this successful system of veterinary service delivery and benefit millions of livestock keepers. FARM-Africa is looking at the potential of doing this through a franchised service model. Franchising offers many advantages including economies of scale, high quality standards and tried and tested business management." GALVmed, a charity and not-for-profit global alliance of public, private and government partners, sees it as crucial to work with partners such as FARM-Africa whose expertise, commitment to community engagement and local distribution networks have forged trust and are improving the lives of poor people who have access to local people and local networks for distribution of vaccines and animal health care.

Source: Adapted from GALVmed.2009.MacDonald Munuve, community animal health worker (Available at http://www.galvmed.org/path-to-progress/macdonald-munuve-community-animal-health-worker)

FIGURE 18 Private veterinary pharmacy selling a range of drugs and small equipment, Kassala, Sudan
(Photo by R. T. Wilson)

Conventionally trained veterinarians and animal health assistants are likely themselves to require specialized training in small animal production if they are to ensure effective animal health care. In order to ensure a sustainable animal health system a mixture of public and private financing is required but all financial costs related to drugs and services should be paid for by the small animal producer.

Transport infrastructure

One of the largest marketing costs farmers face is that of transporting goods. Building roads and improving the surface of existing roads reduces both the time and cost of getting produce to market. Investment in the development of essential infrastructure, such as roads and communications, can be justified partly on the economic benefit derived from small animal production and on the expectations that more benefits will follow from the development of other farm and non-farm businesses.

A key factor in establishing commercial production is access to market. It is not advisable to develop a commercial small animal production

enterprise unless it is physically possible to get the product to market. Whatever form of transport is used it must be adequate to maintain the quality of the product. For specialized transport, such as that possibly requiring a cold chain, market intermediaries have a more pertinent and specialized role. Commercial transporters are likely to have better access to financial and physical assets and are probably in a better position to make up a bulk consignment with the required quantity and quality.

Transport costs are often one of the highest outgoings in marketing. Transport therefore needs to be carefully planned and managed. Whereas small animal production would have difficulty in making a case for new transport and transport infrastructure it could, together with other similar initiatives, apply pressure to local authorities to ensure that transport infrastructure is functional and maintained so that vehicles can move speedily and safely and not suffer heavy maintenance and fuel costs. Roads that are badly maintained and cause problems in connecting rural to urban areas can be considered a major marketing constraint.

Public policy

Livestock policies in general in developing countries, if they exist at all, are often based on standards from developed countries with a modern livestock sector where home and small-scale processing have been forced out of operation and have virtually disappeared. Many of these policies are clearly inappropriate in developing countries where very high standards of processing and marketing cannot be maintained and especially where consumers are not willing or cannot afford a higher price for animal products.

Formal and informal markets are important in responding to consumer demand. Realistic standards for both need to be considered. Standards and food safety are important for development of the formal market. The cost of processing, packing and transport through the supply chain require regulating to protect against unfair competition. The public health hazards of transmission of zoonotic and other diseases are real but need to be balanced against the complications and cost of control. Producers in urban and peri-urban areas generally benefit most from an unregulated market whereas more distant producers suffer. Policy should aim to strike a balance. Public health concerns need to be considered and addressed in ways that deal with the realities of local markets without threatening smallholder livelihoods.

Policy interventions should include:

- promotion of village/household processing systems for local markets;
- guidelines for quality control and food hygiene appropriate and directly applicable to producers, collectors and processors in both the formal and informal parts of the private sector (it is perfectly possible to develop a guide for good hygiene practices(GHPs) for all participants that strike a balance between the economics of smallholder production and marketing and public health issues);
- promotion of systems in which producers benefit economically from the added value of better quality (quality is an important factor in setting prices); and
- provision of information and education for all stakeholders in the chain from producer to consumer as this is important to ensure the proper quality of the products. Licensing of traders and processors to allow monitoring of quality and handling procedures could be a means to achieve this but licensing in itself is not sufficient and further training is essential for improving product quality.

In many developing countries participation by rural people in the political process is virtually non-existent, in part because of their low level of organization. To realize the full benefits of small animal production strong producer-managed organizations need to be established and developed at local and higher levels in order to maximize the impact of the small amount of product produced by each farmer. History has demonstrated that strong producer organizations based on the production and marketing of farm goods also empower the community in other aspects of life. This can help the community to have considerably more influence on policy decisions associated with their daily life.

Improved, more efficient and sustainable livestock production leading to improved livelihoods can pressurise public services into providing additional support. Infrastructure development in many rural areas has generally been very slow and participation in decision making by the rural poor has been limited. When, however, smallholders provide increased revenues to local authorities they have a right and can expect a response to demands for greater investments in infrastructure and services.

Sustainable services for all

Services provided need to be accessible and appropriate to all those involved in small animal production and marketing. This means, for example, that small-scale farmers can access training as well as small animal traders. Very much the same is valid for other services required by this particular sector: access is fundamental. Further services need to be sustainable: services are provided for the long-term and resources and planning are devoted to this goal. There is little or any use in having services up front that only operate efficiently and effectively for a short period of time and then cannot continue as a result of resources. Services need to be seen from a long term perspective and importantly consider the need for constant improvements and updating of services.

Dissemination of information through training and extension is one of the fundamental aspects of support services for small animals and those involved. However, and as stated previously, services need to incorporate improvements and updates that, for example may derive from research and development in improved animal breeds. The use of technology should also be considered as a viable option, especially in terms of wireless communication technology and all its advantages that its operation can provide to rural and remote regions. Media can also be very effective in making services sustainable and accessible, radio is a prime example of this.

Embedded within support services there is the need to promote humane treatment of animals as well as sustainable production that considers environmental impact, use of natural resources, and careful use of hazardous inputs. Materials and resources required for production need to be sourced locally and local alternatives found. For example equipment and tools should be obtained, maintained and repaired locally. This contributes to the livelihoods of others in the locality. The more sustainable projects will strive to use available assets and not depend on imported resources or equipment.

Sustainable production does require sustainable services. In the environmental and economic contexts of the twenty first century there is a need for a mix of service providers, for public-private technical partnerships and collaboration, and for a combination of public-private and individual financing (see Table 3).

The design of support strategies mainly depends on the intentions of the organizing agency and responsible authorities, their financial, technical and managerial abilities and the general economic and political framework in which the strategy is to be embedded.

TABLE 3 **Matrix of services and providers for sustainable service provision for small animal production**

Service	Provider	Financing	Supervision	Comments
Base breeding stock	Private	Private/ Individual	Private/ Public	Species endangered in wild should be obtained from captive bred/farmed animals
Preventive veterinary services	Public	Public/ Private	Public	Some services could be contracted to private sector
Clinical/ Curative veterinary services	Private	Private/ Individual	Public/ Veterinary Associations	
Food safety	Public	Public	Public	
Advisory/ Extension services	Private/ Public	Private	Private/ Public	Some public financing possibly justified
Feed supplies	Private/ Individual	Individual	Private/ Public	Public responsibility for quality standards/feed description
Processing/ Marketing	Private/ Associations	Private/ Individual	Private/ Public	Public oversight of quality/ hygiene standards
Research/ Laboratory services	Public/ (Private)	Public/ Private	Public	Some services possibly contracted from public to private
Financial services	Private	Private	Private	Fully recoverable at realistic interest rates
Training/ education	Private	Private/ Individual	Public/ private	
Infrastructure	Public	Public	Public	Roads/Markets; cost recovery should be in place

Role of the advisor

Relevant, effective and demand-driven agricultural advisory services are essential if small holder producers are to supply the quality products that consumers are demanding. Good advisory services are required to promote and advise on production and marketing matters as well as understand the small animal subsector and overall agricultural sector and related trade.

Areas advisors need to address are:

- Understand the small animal sector at the national level and in the local area of interest.
- Collect information on opportunities and challenges in the short and long term in the particular sector.
- Estimate the potential of various small animal breeds in the geographical area of interest.
- Feasibility of small animal enterprises in the geographical area of interest as related to small-scale farmers and other actors in the supply chain.
- Ascertain the required input supply chain for the area and materials required, along with prices, suppliers, etc.
- Appraise local supply chains in the livestock sector.
- Determine the financial institutions in the area of interest, credit availability and accessibility, terms and conditions, etc.
- Advise on profitability and costs for a small animal enterprise.
- Provide production and marketing advice.
- Promote the formation of associations.

Opportunities and challenges

Opportunities

Given the economic and ecological advantages of small animal farming it deserves considerably more attention than it has so far received. The need to produce animal protein for a relatively modest investment is more pressing than ever at a time when the price of other animal proteins such as fish and meat from large animals is soaring in most countries. Small animal keeping should not be seen as a rival to classic livestock rearing but as a complement to other farming activities. Small-scale farming of small animals that can easily be managed by women should be more widely seen as a valuable weapon in the fight against malnutrition and poverty. It provides protein to the poorest families and especially children who would otherwise eat no meat at all in cultures where tradition dictates that the head of the family should take priority.

In many parts of the world consumers prefer so-called bush meat which is considered a much greater delicacy than beef or sheep meat. In many large towns clients nostalgic for the flavours of their home villages are prepared to pay a premium for farmed small animals both in their countries and even among those who have immigrated overseas. This trend helps to promote peri-urban and urban farming of these small species. The fact that this type of activity has its own name shows that researchers and livestock experts are at last ready to recognise local species long prized by communities in many tropical countries. The keeping of small animals is an affordable solution for women, young people and landless farmers since it requires little space and needs only basic equipment that is cheap and easy to make.

The major problems facing increased use of small animals are conventional attitudes to change and to the unknown. The types of husbandry discussed in this booklet are already accepted by many small-scale and poor farmers and others who are faced with little choice in the activities they undertake. A small sample of the possibilities for managing and reaping the benefits of a wide range of 'livestock' types and 'species' has already been discussed. There are almost limitless opportunities for developing other species. Research on and development

of these opportunities will support an effective contribution of tropical livestock to sustainable production, environmental conservation and the maintenance or enhancement of biodiversity.

The main opportunities lie in recognising the potential of products and markets. Strategies aimed at sustainable development need to build on real growth potential that enables people to generate at least part of the funds to pay for the necessary services. Among the main opportunities are:

- using the comparative advantages of smallholders;
- targeting local markets that are well known by smallholders;
- build on existing market links to explore the possibilities for adding value through cottage industries, including the development of non-traditional products from conventional raw materials and the potential that lies in the transport, packaging and marketing services related to agriculture;
- promote product differentiation within established markets rather than establishing new products in a tough food market, strategies should look for product differentiation in already established markets, for example, organic and fair trade variants;
- domesticate and regularly produce marketable wild species. Shifting from collecting and hunting to breeding not only avoids ecological damage but also creates jobs, as for example with the West African grasscutter which provides an excellent case of an emerging industry with breeders and craftsmen making cages;
- target high value market segments. Even in developing countries there are increasing numbers of supermarkets and hotels that offer new outlets for high value local fresh products.

Challenges

Providing sufficient food of sufficient quality is one of the world's major challenges in the twenty first century. Producing this food will lead to food security, improved human health and a higher plane of nutrition. To achieve the result sustained increases in animal production and productivity will be required.

Among the major constraints for successful development of the small animal subsector are:

- inadequate attention in both the public and private sectors

to research and training for small animal producers and production;
- inadequate services for inputs including feed and finance and animal health;
- weak producer organizations that suffer from poor management and lack of political influence;
- poor or non-existent infrastructure (which is a general constraint for economic growth in rural areas); and
- unreliable and costly access to profitable markets and lack of market information.

Developing a technically and economically viable small animal subsystem is a complex and long term process. Challenges litter the route to success. These include technological, economic, social and political challenges at both the micro- and macro-scale. Amongst the final major challenges are:

- identifying small producers' objectives (subsistence, semi-commercial, commercial);
- identifying market opportunities and ensuring that they are evaluated correctly before commercial production begins; and
- finding or providing financial support in the initial stages of the enterprise.

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Sources of further information and support

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Notes

Notes

Small animals have a large potential and provide numerous opportunities to support smallholder farmers and their livelihoods. They require minimal inputs as a farm enterprise and fit well into farming systems. Feed can be sourced locally, minimal labour and capital are required and they are adaptable to rural, peri-urban and urban farm settings. Their small size facilitates herd management and marketing. Small animals provide meat at low cost for small-scale farmers and at affordable prices to consumers enabling access to animal protein even to the poorest members of a community. Their furs, hides and skins can also be successfully traded.

It is hoped that development workers, policy-makers and others involved with small-scale farmers recognise the opportunities and benefits that can derive from small animal enterprises and implement projects and development plans that foster such enterprises and improve small-scale farmers' livelihoods.

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