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Information for action

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Local Livestock For Empowerment of Rural People

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LEAGUE FOR
PASTORAL PEOPLES

The League for Pastoral Peoples (LPP) is a non-profit organization devoted to advocacy and technical support to marginal livestock keepers, in particular pastoralists. It was founded in 1992 in Germany. Activities focus on research, training, capacity building and networking in co-operation with partner organizations. LPP promotes the concept of endogenous livestock development utilizing indigenous animal genetic resources and building on local institutions.
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Middle: Water transport in Niger (Wolfgang Bayer)
Bottom: Farmer in Maharashtra, India (Ilse Köhler-Rollefson)

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Part 1: Putting the conservation and sustainable use of farm animal breeds on the international development agenda

Why this dossier?

Farm animal diversity is vanishing at an alarming rate. As industrial livestock production expands, it is relying on fewer and fewer breeds. Already, 15% of the world's livestock and poultry breeds are extinct, and another 35% are endangered. We are coming to depend on a livestock population with a dangerously narrow genetic base: because of their genetic uniformity, huge numbers of animals could be wiped out by a new disease.

Locally adapted animal breeds carry genetic material of immense value. These breeds must be conserved. The only realistic way to do so is by maintaining the production systems they are part of – by supporting the small farmers and pastoralists who manage these animals.

This dossier is intended for decision-makers and field staff from governmental and non-governmental institutions and organisations working on agriculture, livestock production, natural resources management, food security and other aspects of rural development in the South. The goal is to stimulate policy makers, project staff and members of grassroots organisations to support in their policies and actions the sustainable use and community-based management of farm animal breeds.

The twentieth century has witnessed spectacular advances in many areas, including agriculture and medicine. The consequences have been both positive and negative: extended human life spans, increased food production and other achievements stand against a staggering growth in population, widespread environmental degradation and the fact that about 826 million people, or about 13% of the world's population, still go hungry.[1]

The development of high-performing livestock and poultry breeds has no doubt greatly contributed to the increase of food production, especially in temperate climates. But their indiscriminate export into tropical countries has often ended in failure, as the animals cannot stand the heat, need optimal inputs and readily succumb to disease. To overcome these weaknesses, the ongoing approach is the widespread promotion of crossbreeding high-yielding breeds with hardy and well-adapted local animals. The price of this and other developments is high: local breeds are disappearing at a rate of two breeds a week.[2] This has far-reaching consequences, not only for our generation but also for the generations to come.

Preventing further losses and conserving local breeds is not a romantic or nostalgic adventure; it is a must. The situation is urgent: we risk destroying valuable resources; reducing the world's ability to react to changing nutritional requirements, unforeseen diseases, and natural disasters; and endangering the food security not only of the poor but of us all. The loss of local breeds means a reduction of the part of the world that can be sustainably utilised by humankind.

To be effective, measures to maintain local breeds have to be as broad and diverse as possible and involve stakeholders at all levels: farmers and herders, staff of non-government organizations (NGOs) and extension services, government organizations (GOs), donors and policy makers from all over the world. So far activities have

consisted mainly of the acquisition and distribution of information, with little involvement of the farming and herding communities that have developed and stewarded the local breeds. Only recently this strategy – the involvement of communities – has been recognized as an important tool for the effective management of animal genetic resources. It involves herders and farmers as equal partners and enables them to optimise their livestock systems, continue the use their breeds and market their products. It also implies a paradigm shift from the emphasis on high-input intensive agriculture to sustainable livestock production.

The dossier is divided in four sections:

- **Part 1** summarises the most important facts and issues around local breeds, their loss and conservation measures.
- **Part 2** is composed of five case studies that illustrate how to combine sustainable use of local breeds with achieving food security and enhanced livelihoods for rural people.
- **Part 3** contains a set of selected papers that provide details and background information on the facts and issues highlighted in Part 1.
- **Part 4** consists of a list of organizations involved in the conservation of local breeds; a small glossary of terms such as '*species', 'breed'* and '*in-situ*' and '*ex-situ conservation*'; and a list of abbreviations.

Biological and cultural diversity – treasures at stake

Since the beginning of life on earth an incredibly rich diversity has evolved. So far about 1.7 million plant and animal species have been identified. But this is only a small part of the actual biodiversity: there may be as many as 13 million species: estimates vary between 3 and 100 million.[3]

About 10,000 years ago people began to domesticate and use animals from about 40 species. Through breeding, selection and environmental influences, these species diversified into more than 6000 livestock and poultry breeds, each adapted to a particular production environment. About 90% of the animal products and services are contributed by only 14 species.[4,5]

Throughout history, there has always been some loss of diversity: some species and breeds disappeared, while new ones evolved. During the 20th century, however, the loss of diversity has dramatically increased. It is estimated that per year about 34,000 plant and 5,200 animal species disappear, a rate 50-100 times higher than the losses expected through natural processes.[6]

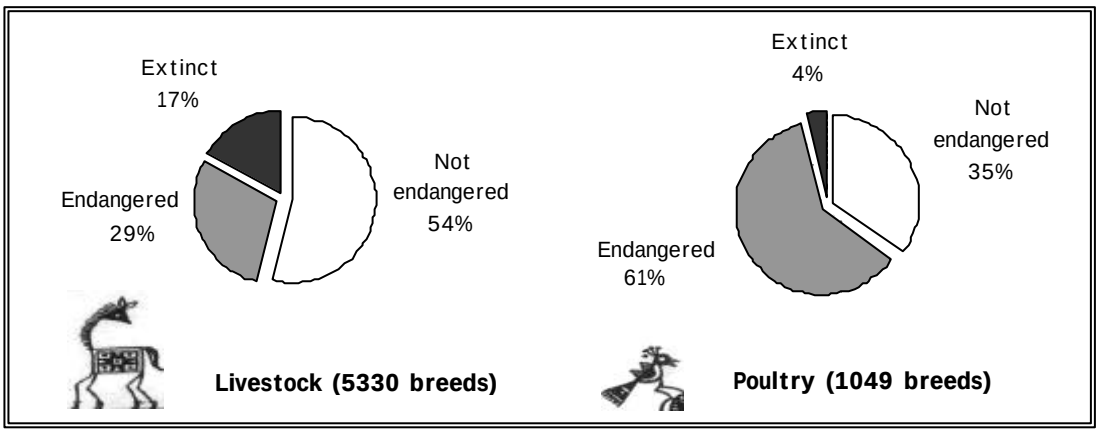
With regard to farm animals, about 1,000 of the 6,400 recognised breeds became extinct during the last 100 years, and 300 of these alone during the last 15 years.[7] The Food and Agriculture Organization warns that another 2,000 breeds are at stake if no countermeasures for their conservation are taken (Figure 1).[8]

The alarming rate of diversity loss is linked to the loss of cultural and linguistic diversity: human cultures and languages are also vanishing rapidly. According to the World Wide Fund For Nature (WWF)[9], about 600 languages have disappeared during the last century and half of the remaining approximately 6,000 languages are highly threatened. If a culture disappears, it irretrievably takes along a wealth of knowledge and the domestic animals and plants that had been the basis of its food production system.

The Convention on Biodiversity

In 1987, the Brundtland report *Our Common Future* drew attention to the loss of biodiversity of plants and animals. The growing evidence of the accelerating depletion of natural resources and other environmental and social problems has resulted in a global consensus on the need to focus attention on the long-term sustainability of development. This has been accompanied by the interest in related issues, such as the conservation of biological diversity and local knowledge systems.

Figure 1. Domestic animal diversity at stake (modified after GAA 2001[10], Source: Scherf 2000[11])



In 1992, the United Nations Conference on Environment and Development negotiated the Convention on Biological Diversity (CBD), an intergovernmental convention that came into force in 1993. It is now ratified by 180 countries[12], which commit themselves to:

- the conservation of biological biodiversity,
- the sustainable use of its components and
- the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.[13]

The conservation agenda of the CBD originally focused on wild ecosystems but later the decision II/15 of the Conference of Parties (COP) to the CBD recognised the specific nature of agricultural biodiversity, which refers to all components of biodiversity found in crops and animals used for food and agriculture. This resulted in a *Programme of Work on Agricultural Biological Diversity* established in 1996.[14]

However, public awareness has largely remained restricted to wildlife and crop diversity. Under the leadership of FAO the International Treaty on Plant Genetic Resources for Food and Agriculture – a voluntary agreement drafted in 1983 – has been negotiated for the past seven years and was adopted in November 2001. It is now governing the use of plant genetic resources for food and agriculture in a legally binding form.[15] A similar agreement for food animals still seems to be far away (see below).

☞ The paper *Implementing the Convention on Biodiversity with respect to domestic animal diversity* in Part 3 contains additional information on the CBD and its implications for animal breed diversity.

‘Species’, ‘breed’ and other definitions

We mentioned above that presently about 6,400 animal breeds of 40 species are recorded in FAO’s database.

‘Species’ refers to a group of animals whose members freely mate with each other and produce fertile offspring . For example, horses and donkeys are different species because, although they may be able to mate, their offspring (mules) are not fertile.

The term ‘breed’ is more difficult to define, but it is most often understood as a group of animals ‘with definable and identifiable external characteristics that distinguish it from other groups within the same species’.[16] Well-known examples of livestock breeds are the Holstein-Friesian cow and the Merino sheep. But this definition is more suitable for developed countries, where the physical characteristics of breeds are defined by breeding societies.

In developing countries, breeds are commonly the products of a specific society or culture. The term ‘local’ is used in this dossier to contrast the breeds that are the result of centuries of selection and use by ethnic and social groups living in confined habitats, from ‘international’ high-performing breeds produced through very intensive selection for one or few production traits and the use of biotechnologies in a relatively short period.

Other terms frequently encountered in connection with local animal breeds and their conservation are ‘domestic animal diversity’ (DAD) and ‘animal genetic resources’ (AnGR). The latter term makes reference to the fact that each animal carries a specific set of ‘genes’ – DNA codes that determine how an animal looks and develops. An animal’s genes are a combination of the genes from both parents. Both terms are collective names for the whole spectrum of local breeds and the genetic information they harbour.

Factors shaping diversity

A wide diversity of domestic animal breeds is found in Asia, Latin America and Africa. Cultural needs and preferences, people’s knowledge and ecological conditions have all been factors in the manipulation of the animals’ traits and characteristics.

Whereas adaptation to natural and environmental conditions has a low priority in intensive systems, it is essential for the extensive systems in which pastoral people and livestock raisers in developing countries keep their animals. In harsh environments, animals can survive only if they can cope with fodder shortages, climatic stress and the prevalent diseases.

The combined influence of human selection and ecological factors has, for example, led to the development of the Yakut horses in Siberia. These horses are able to graze on pastures covered with 50 cm of snow, and they survive temperatures of –70ºC.[17] The Raika in Rajasthan have selected and bred sheep highly adapted to the extreme temperatures of the region. They commonly keep a mix of breeds able to cope with different challenges, so as to be optimally prepared for all eventualities.[18]

Another outcome of century-long human and natural selection, breeding and management is the enhanced ability of many indigenous breeds to cope with diseases. Southern Africans have developed the Sanga cattle, which are resistant to East Coast Fever and to the ticks that spread this disease.[19] N’Dama and at least 15 other cattle breeds in Africa are trypanotolerant, meaning they are less susceptible than other animals to trypanosomiasis, a disease of major economic importance.[20]

☞ The section *Intellectual property rights and benefit sharing* in Part 1 has further examples of disease resistant breeds.

☞ The papers *Africans manage livestock diversity* and *African cattle genetic resources: Their unique attributes and conservation through utilization for milk production* in Part 3 provide examples on the development and management of animal breeds in Africa.

Importance of local breeds

Maintaining a wide spectrum of local animal breeds is crucial to food security, poverty alleviation and sustainable development.[21] More than half of the world's people depend at least in part on livestock for their livelihood, and 12% are entirely dependent on livestock production.

Local breeds play an important role for the livelihoods of herders and smallholders and in the utilization of marginal ecological areas. They provide a wide variety of products and yield important non-monetary benefits:

- Food, fibre, fertilise and fuel.
- Cash income.
- Draught power and transportation.
- Savings account.
- Buffer against crop failure and other risks.
- Employment.
- A way to access and use common property.
- Support for the social network and culture.

Keeping multipurpose livestock is part of a survival strategy which people have developed to cope with extreme climatic and environmental conditions. In some areas, it is only livestock that enable people to exist, since the potential for growing crops is limited or non-existent.

Although in extensive production systems hardiness and adaptability to extreme conditions have priority over production traits, local breeds can have a remarkably high production potential (Box 1). Dahlin, who intensively studied Sahiwal cattle in South Asia, points out that there is a 'tremendous genetic variation among individuals that could be utilised for further improvement of the breed'.[22]

Box 1.
The production of local breeds can be optimised through selection and breeding

One of the survival strategies of herders and small farmers is risk minimisation rather than product maximisation. As a result of this strategy, and because of insufficient feed, local breeds often produce little compared to improved breeds. However, there is opportunity for breed improvement through enhanced selection for production traits. Nicobari fowl in India, for example, can lay up to 162 eggs under free-range conditions.[23] Jamunapari goats and Sahiwal cattle are high potential dairy breeds in India and Pakistan.[24,25] In Ethiopia, a study compared the performance of crossbred (Anglo-Nubian x Somali) and local goats. The improved goats grew faster but were more susceptible to weight loss during the dry season. Improved goats gave more milk per animal, but this was not the case, when calculated in relationship to the animal's bodyweight.[26]

Local breeds also score well if the benefits of the whole production system are considered, rather than the productivity of the individual animal. In the 1970s, a

comparison of traditionally raised versus ranched cattle in Botswana showed that the former multi-purpose herds were 95% more productive than the single-purpose beef cattle on ranches.[27] Also the Ethiopian goat study mentioned in Box 1 showed that crossbreed goats did not generate higher benefits than the local breed. But such comprehensive studies are still rare – they are difficult to implement, and the recognition that such studies are needed is growing only slowly.

Why are breeds disappearing at such a rate?

Reasons for the high extinction rate are manifold and interrelated. They include: the intensification and industrialization of agriculture and animal production; the large-scale promotion of uniform high-yielding breeds and crossbreeding; policies and developments that disadvantage ethnic minorities; conflicts and wars; natural disasters; and inappropriate development aid focussing on short-term benefits. The following section elaborates on some of these issues.

High-performing uniformity replaces multipurpose diversity

Whereas animal production systems in developing countries often keep a variety of breeds and species of livestock and poultry, animal production systems in North America and Europe commonly rely on very few breeds or species. The diversity is even further reduced, when comparing animals of the same breed. They are quite uniform as very few intensively selected male animals are used to produce large populations for commercial purposes. This has led to the expansion of, for example, Holstein cattle, a breed dominating milk production: It accounts for 60% of European and 90% of North American dairy cattle. By 2015, it is projected that the genetic diversity within this breed will correspond to that of only 66 animals.[28]

Intensive sire selection is leading to rapid inbreeding rates and raises questions about the long-term sustainability of high-input, high-output production systems, which rely on very narrow gene pools. If a disease that the breed is susceptible to breaks out, the economic damage can be enormous as all animals have the same ability (or disability) to cope with the disease. The situation is different for herds consisting of less uniform animals because some may be able to resist the disease and thus slow further spread.

Breed imports and crossbreeding reduce local stock

For the past decades, the import of exotic breeds and more recently crossbreeding have been widely promoted in developing countries. But many attempts have proven unsuccessful.[29] Although crossbreeding with exotic breeds has advantages under certain circumstances, it can also have negative consequences:

- Large-scale crossbreeding without appropriate measures to conserve sufficient numbers of purebred animals threatens the survival of the local breed.
- Crossbreeds may not be as well adapted to local climatic and management conditions as the local pure breed. Even if a crossbreed's production potential is higher than that of the local breed, its performance might be poorer under the given conditions. It may need more and better fodder and improved management, as it may be less resistant to the prevalent diseases.
- As noted above, livestock in developing countries is often kept for multiple purposes. Changing an animal's characteristics by improving one trait (e.g. milk production) can negatively affect other traits (e.g., an animal's work ability).
- The introduction of exotic (cross)breeds can implicate a change in the gender-labour division. In many cases, it will mean a bigger workload for women. However, it can also deprive women of their income. For example, replacement

of local cows with high-performing dairy crossbred animals means commercialisation and therefore to more prominent roles for men.

Policies disadvantage pastoralists and low-input production systems

Many distinct livestock breeds have been developed and sustained by pastoralists. But few governments are supportive of this population group. The collapse of pastoralism due to unsympathetic development policies leads to the disappearance of local livestock breeds. This in turn triggers a cascade of socio-economic consequences such as hunger and impoverishment among the pastoralists, loss of their cultural identity and emigration to the cities.

Policies and subsidies commonly favour intensive large-scale producers, neglecting the fact that pastoralists and smallholders can make a substantial contribution to the economy. In India, for example, livestock contributes about 30% of the total farm output, and 80% of livestock products come from small farmers with 3–5 animals and less than 2 hectares of land.[30] Nevertheless, official development strategies such as that in the Indian State of Andhra Pradesh favour large-scale commercial dairy and poultry complexes and promote crossbreeding.[31]

☞ The paper *Food insecurity and industrial animal farming* in Part 3 discusses the intensification and industrialisation of agriculture and animal production, the large-scale promotion of uniform high-yielding breeds, crossbreeding, policies and developments that threaten animal domestic diversity.

The conservation of local breeds

The debate on the conservation of agricultural biodiversity concentrates on two approaches: *ex-situ* and *in-situ* conservation. '*Ex situ*' refers to conservation approaches outside of a breed's natural habitat – for example, in zoos and in gene banks. '*In situ*' is 'the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings, and in the case of domesticated […] species, the surroundings where they have developed their distinctive properties' (Article 2 of the 1992 Convention on Biological Diversity).

There is a growing consensus that the most rational and sustainable way to conserve farm animal breeds is to maintain them as a functional part of local production systems.[32,33,34] Measures should be comprehensive and enable communities to continue and improve their animal production through:

- Instituting supportive and enabling policies, for example by ensuring access to pastures and markets.
- Exploring and generating niche markets for specialty livestock products. In France, this approach has led to the revival of the Aubrac milking cow. It has also been a remedy for the low profitability of the camel production system in different parts of Rajasthan (see Part 2 for details).
- Considering the requirements of the breed in land-use plans.
- Keeping alive the knowledge that the keepers have accumulated on the breeds, their management and other related aspects. This should become a prior concern because the erosion of the knowledge is even faster than the erosion of breeds.[35]

Efforts in this direction require the active involvement of farmers and herders who own and use these animals. Community-based management of farm animal breeds fulfils the foregoing requirements (Box 2).

Present state of conservation

The Food and Agriculture Organization (FAO) has taken the lead in the worldwide acquisition and dissemination of information on local breeds and other *ex-situ* conservation efforts. Another important player in these areas has been the International Livestock Research Institute (ILRI) in Nairobi, Kenya.

Box 2.

Community-based management: The key to success

Community-based management is a rural development tool that recognises the need to involve grassroots stakeholders, namely herders, farmers and non-government organisations in the conservation of farm animal breeds. It is a dynamic approach that:

- Combines sustainable use of livestock breeds with empowerment and poverty alleviation for farming and pastoral communities.
- Builds on experiences made during community-based natural resource management projects and indigenous knowledge and values.
- Recognises participatory approaches, appropriate institutional support, and integration of all stakeholders as critical success factors.
- Strives for policy frameworks, marketing opportunities, intellectual property rights regimes and economic valuation of local breeds.

Beginning in 1988, FAO's activities have included setting up gene banks in Africa, Asia and Latin America, publishing the *World Watch List for Domestic Animal Diversity* (now in its third edition[36]) and setting up a database on animal breeds.[37]

In 1998, an Intergovernmental Technical Working Group on Animal Genetic Resources initiated, under the leadership of the FAO, the development, of a country-driven *First Report on the State of the World's Animal Genetic Resources*. The compilation of this State-of-the-World Report, scheduled from 2000-2005, aims to provide a foundation for setting country, regional and global strategies and get national governments and scientists involved in the conservation of local breeds.[38]

With regard to *in-situ* conservation of farm animals in developing countries, efforts mostly centre on the conservation of selected breeds. Examples are the Vietnamese I-Pig and the Galla goat in Kenya.[39]

Systematic efforts to promote community-based management through appropriate legislation and mobilising herders, farmers and non-government organisations are only at their beginning. One such effort is 'LIFE', an initiative founded in 1999 by a group of NGOs, including the League for Pastoral Peoples and Lokhit Pashu-Palak Sansthan, to involve the prime stakeholders in all stages of breed conservation (Box 3). With the support of the GTZ, LIFE is currently developing and testing a method for documenting local breeds on the basis of indigenous concepts and knowledge, including traditional breeding strategies and mechanisms. The goal of this project is to fully record the intellectual contribution of pastoralists and farmers in sustaining a broad genetic base for the world's farm animals.

Another initiative that seeks to involve communities is the Farm Animal Genetic Resources Management Programme of the Southern African Development Community (SADC), covering 13 countries in southern Africa. In May 2001, a workshop organised by the Ministry of Agriculture of Swaziland, FAO/UNDP/SADC, SACCAR and GTZ (see *List of abbreviations* in Part 4 for the full names of these organisations) recommended to bring the importance of community-based management of local breeds to the attention of FAO; formulate policy frameworks that support research on and implementation of this approach in the Southern African region; and develop policies on the rights of local communities, farmers and breeders

and the regulation of access to and benefit sharing of animal genetic resources. Different follow-up activities have been implemented. An example is an initiative of the South African Ministry of Agriculture, the Animal Improvement Institute, the Provincial Department of Agriculture of the Eastern Cape and GTZ. They have initiated a project to develop a Nguni cattle leather product industry in South Africa (see Part 2 for details).

Box 3.
'LIFE': An initiative to foster community-based conservation approaches

LIFE stands for 'Local Livestock for Empowerment of Rural People'; it focuses on bottom-up approaches to complement the efforts of the FAO that are channelled mainly through governments. The initiative seeks to conserve domestic animal diversity by building on farmers' and pastoralists' indigenous knowledge and institutions within the context of local and regional development. Aims include:

- Promotion of 'endogenous livestock development', which builds on local knowledge, genetic resources and local fodder resources.
- Intellectual property protection for farming and pastoral societies that have created unique breeds.
- Consideration of local livestock in land use and regional development planning and creation of positive marketing environments for its products.

In November 2000 LIFE, in collaboration with the GTZ, organised an international workshop in Rajasthan, India. Approximately 80 scientists, NGO representatives, herders and others participants drew up the 'Sadri Declaration'. This acknowledges the diverse roles of local animal breeds for sustainable rural livelihoods, especially in marginal areas, and urges concerted action such as support for local institutions and breeding organisations and legal recognition of indigenous breeds as national assets.

☞ The paper *Intellectual property rights regime necessary for traditional livestock raisers* in Part 3 provides the full text of the Sadri Declaration.

Such efforts must be supported and expanded to achieve the critical mass necessary to facilitate breed conservation on a large scale (Box 4).

☞ The paper *Marketing rare breeds in sub-Saharan Africa* in Part 3 discusses community-based breeding and marketing strategies.

☞ The paper *Conserving the Aseel poultry* in Part 3 describes a collaborative effort of *Adivasi* communities and four local organisations to develop strategies to preserve and promote the Aseel poultry breed.

Intellectual property rights and benefit-sharing

While industrial livestock-breeding companies and research institutions guard the information about their breeds like trade secrets, farmers and herders seem to be expected to share the genetic material of their breeds and their knowledge for free.

As yet, few benefits percolate down to pastoral and farming communities from activities relating to local breeds conducted by formal sector international institutions. Agendas are pursued predominantly from the so-called 'genetic resource-angle' that seeks to save or rescue breeds in their role as carriers of genetic material that might

have some economic potential in the future and could be valuable for humanity at large.[40]

Box 4.
Support for community-based management should be prioritised

By 2005, when the State-of-the-World Report and its recommendations are to be published (see text), another 300 breeds will have gone (assuming the present extinction rate of two breeds per week). Therefore it is urgent to prioritise conservation activities with and within communities now.

Local livestock keepers, who have been the chief custodians of the world's domestic animal diversity, should directly participate in and benefit from these activities. So far their role in conserving threatened breeds remains largely unrecognised and unrewarded. It is vital that they be able to continue managing and breeding their breeds because only then will the animals be exposed and adapt to changing environmental and disease conditions.

The situation is even more urgent as the consumption of meat and milk in developing countries is expected to more than double over the next two decades.[41] Some major development organisations see the expansion of intensive livestock production into the South as the key solution to meet the rising demand. If this development is realised (and it is already well on its way), millions of small farmers and herders will lose their livelihoods and the extinction of breeds will accelerate further -- despite all conservation efforts.

There is more than a moral obligation for extending similar protection to traditional stockbreeders. Actions are urgently needed as the prospecting of livestock breeds for desired genes has already begun, especially pigs, poultry and cattle.

Unfortunately there is still no movement to assure stockraisers' rights, as is the case with plant genetic resources -- and even in the case of plants, companies have been granted patents on neem, pepper, turmeric and basmati rice, all of which have been developed by local communities.[42] Fighting such patents is difficult and has succeeded only in a few cases, including an antifungal oil made from neem seeds[43] and the medicinal uses of the Ayahuasca plant[44]. In these instances it was possible to prove traditional use prior to the patent but such proof is difficult to bring.

There are already cases of genes being appropriated from indigenous livestock breeds into commercially kept animals. For example, the patented 'booroola' gene that is responsible for a high incidence of multiple births in Australian Merino sheep is thought to have originally been derived from the Garole sheep kept by the Haider community in the Sunderban area of India.[45]

Another example concerns worm-resistant sheep breeds owned by pastoral communities. The world over, farmers spend billions of dollars on chemical drenches to fight intestinal worm infections, leading to increased resistance of the worms against these chemicals. Hence genetic traits conferring worm resistance would be of immense commercial value.

The Maasai in East Africa have nurtured such a breed, the 'Red Maasai sheep' that is genetically resistant, or less prone, to infestation with intestinal worms. In the 1970's, the International Livestock Research Institute (ILRI) became aware of the Red Maasai and its scientists have now developed new research tools to help identify the genes which are responsible for its resistance. The goal of such research is to combine the resistance genes of livestock from developing countries with the

production genes of developed-country livestock to provide optimal animals for both tropical and temperate regions. The prospect that the genetic sequence related to helminth resistance is identified by scientists, raises the question of the ownership of this information and of the genes.

ILRI states 'The world's diverse animal genetic resources have taken millennia to evolve into their current complex diversity. Only by making use of that diversity will we be able to preserve valuable genes for future generations. The modern tools of biotechnology provide us with the weapons we need to win this battle. They also provide us with the means to make fuller use of what nature, with human intervention, has provided – the myriad combinations of genes that are represented by today's livestock breeds and types'.[46] ILRI admits that it 'will need to rely on commercial partners to deliver the results of some biotechnological products to users. These potential partners may not be interested in ILRI products unless they can have intellectual property protection on them, and hence confidentiality becomes important'.[47]

There is clearly a crucial need for an open debate, which involves the main stakeholders, notably the pastoralists and small farmers who have created the breeds in question. As a response to this need different organisations (ILRI, IPGRI, FAO, SADC and GTZ) have initiated a discussion on how to stimulate the awareness and create capacity on access and benefit sharing issues on regional and international level. The proposal is to organize a workshop, which will explore the implications of the existing international legal framework on access and benefit sharing and intellectual property rights on the conservation and sustainable use of local breeds.

At the NGO level, LPP is joining forces with like-minded organisations to press for negotiating an International Treaty on Animal Genetic Ressources. In collaboration with the German Forum for Environment and Development, as well as other NGOs, LPP is also organising a special workshop during the *World Food Summit: 5 years later* in Rome in June 2002 to alert attending delegates about the rapid erosion of farm animal genetic diversity and the necessity of involving farmers and pastoralists in conservation.

☞ The paper *Intellectual property rights regime necessary for traditional livestock raisers* in Part 3 discusses the need to recognize the intellectual property rights of pastoralists and other traditional domestic animal raisers.

Recommendations

Grassroots level

- Involve local communities that have developed unique livestock breeds in all stages (decision making, planning, and implementation) of conservation projects.
- Document local livestock breeds from the perspective of their owners, adopting their concepts and terminology, and recording their knowledge about animal breeding.
- Evaluate the economic benefits of local breeds in the context of local livelihoods.
- Prepare genetic impact assessments (i.e. evaluate the qualities of the existing breeds and the impacts on them of a possible project) before promoting exotic or non-local breeds.
- Develop the capacity of NGOs and extension services to support community-based management of local livestock breeds and implement related projects.

National level

- Increase awareness of the value of local breeds and their significance as a reservoir for certain genetic traits.
- Focus on improving the competitiveness of local breeds by means of selective breeding rather than cross-breeding.
- Incorporate the conservation of existing local livestock breeds into regional development plans.
- Provide secure land rights and access to water and grazing resources for pastoralists.
- Eliminate subsidies and credit for resource-intensive agriculture in marginal areas.
- Promote the development of markets for products and speciality items from local breeds.
- Give emphasis to the sustainable use of indigenous breeds in the training and curricula for the various groups involved in livestock development (e.g., veterinarians, animal scientists, extensionists), and build capacity in this field.
- Facilitate indigenous communities to enter decision making and policy processes and national bodies by supporting intermediary NGOs.

International level

- Put in place policies and legislations that enable and courage farmers and pastoralists to continue keeping local breeds.
- Stop promoting the indiscriminate expansion of animal industries in developing countries. Livestock keepers in marginal areas are in danger of being squeezed out of the market by such capital-intensive enterprises.
- Create a special forum for discussing IPR issues related to animal genetic resources.
- Support development of international framework regulations – similar to the International Treaty on Plant Genetic Resources - that recognise pastoralists' and smallholders' rights over the breeds they have created.

Endnotes

[1] FAO. 2000. *Ernährungssicherheit: Wenn Menschen mit dem Hunger leben und den Tod durch Verhungern fürchten*. Food and Agriculture Organisation of the United Nations, Rome, Italy.

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Part 2. A different approach – case studies on the importance and sustainable use of local breeds

This part presents case studies demonstrating the importance and potential of indigenous breeds and community-based management approaches.

Local goats are as good as crossbreeds

The Government of India and Swiss Development Co-operation initiated the Indo-Swiss Goat Project (ISGP) in Rajasthan, which aimed at improving goat production in semiarid environments in order to raise family income and improve the nutrition of the rural poor. The performance of local milk goats was to be enhanced by artificial insemination with semen from imported bucks. At the onset in 1981, both partners knew little about local goat husbandry. In 1988, an innovative system to keep track of animal performance was introduced: recording was done in the field rather than on a government farm. 'Field performance recording' and a study of the local farming system revealed that the crossbred animals were not superior to the local goats under the given conditions, and that the new breeding technology was not appropriate for the extensive agropastoral production system. The project was reformulated to promote selective breeding within the local Sirohi breed, using field performance recording to identify superior bucks for natural service.

However, small ruminants played only a marginal role in the livestock policy of Rajasthan State. The Animal Husbandry Department showed no interest in the project. By mutual consent, the project was closed in 1992. Fortunately, the knowledge gained and the approach of field recording and selective breeding was taken up by BAIF Development Research Foundation, a strong Indian NGO with keen interest to promote the 'poor (wo)man's cow'. The ISGP was very well documented, thus allowing others to learn and benefit from the work carried out.

Source:
Indo-Swiss Cooperation. 2000. *Capitalizing on experience in Indo Swiss cooperation in livestock development in India.* Intercooperation, Bern. P. 26.

Revival of the Aubrac milking cow

Traditionally, the Aubrac cow has been used as a draught animal and its milk was used to produce a local pressed fresh cheese called Laguiole cheese. Because of mechanisation and for social and economic reasons, the number of Aubrac cows being milked dropped in the 1920s. However in the 1960s Laguiole cheese was still wanted and the 'Young Mountain' Cheese Cooperative was created to collect milk from producers and make the cheese. Farmers started experimenting with Holsteins. However, these breeds could not thrive on the mountain fodder, and their milk was low in protein, resulting in much rejected cheese. Thereafter farmers started experimenting with the multipurpose Simmental breed. Although this breed was better adapted to the mountains, the farmers were still not satisfied. This led to re-introducing the Aubrac cattle breed in the early 1990s.

Source:
FAO. 1999. *Sustaining agricultural biodiversity and agro-ecosystem functions. Opportunities, incentives and approaches for the conservation and sustainable use of agricultural biodiversity in agro-ecosystems and production systems.* Food and Agriculture Organization of the United Nations, Rome, Italy.

Preserving the one-humped camel in Rajasthan through camel milk marketing

In Rajasthan, India the camel production system has lost its profitability. Camel herd sizes have been reduced significantly. The decrease can be attributed to an interrelated set of circumstances: a shortage of grazing lands, the impact of diseases, and the delayed and reduced fertility of female camels. It is therefore not surprising that many Raikas (the traditional camel herders) thought that all camels would disappear within ten years, and that camel breeding was dying. Some years ago the idea of selling camel milk was brought up. At first many Raikas were unwilling to consider marketing of milk for cultural reasons. However, in Udaipur and Chittor some started selling camel milk to tea stalls and to private households, even dairies. The idea spread throughout southern Rajasthan and into northern Madhya Pradesh. For many Raikas, the income from camel milk exceeds that gained from the sale of male animals. The camels are milked twice or three times a day. The average amount of milk obtained per day per camel is about 2 kg.

Most of the milk is bought by tea stall owners. Camel milk is significantly cheaper than buffalo or cow milk. This explains to a large extent the popularity of the camel milk. Furthermore the milk is said to have a neutral taste and has a longer shelf life, so it can be stored for a longer period outside the refrigerator.

Although the Raikas still face many problems, such as a lack of grazing opportunities and a decreasing quality of their camels, the marketing of camel milk forms an incentive for many to re-invest in camel breeding and in the conservation of the one-humped camel in general.

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Conserving the South African Nguni through utilisation

The Nguni is a hardy breed of cattle that survives in the harshest and most disease-infested areas of Africa. It is mainly found in Swaziland, Zululand and Mozambique. Although the Nguni is becoming increasingly popular as a beef breed, it was originally a draft animal that played an important social role. In Swaziland the standard bride price until today is 15 head of cattle.

Because the South African government regarded this breed as inferior, it started crossbreeding programmes with exotic stock. In Swaziland, American development aid promoted Brahmin cattle, while the British sponsored the introduction of Hereford cattle. As a result the number of pure Nguni cattle had decreased significantly at the end of the 1990s, although some white farmers had started buying up pure Nguni cattle in the 1970s. The crossbreeds needed a high level of management and healthcare services. When input supplies broke down in the 1990s because of political changes, the crossbreeds could no longer perform economically. This led to the re-evaluation of the Nguni breed. This evaluation highlighted its potential for beef production. Furthermore, Nguni proved to be the most fertile breed in South Africa. The cows are less prone to birthing difficulties because they have sloping rumps, a small uterus and low birth mass. Besides, cows have good mothering qualities.

Other qualities of the Nguni include heat and light tolerance. Animals have an excellent resistance to ticks and immunity to tick-borne diseases, and disease incidence and mortality are low. They are excellent foragers and will graze and browse on steep slopes and in thick bush. Nguni fatten well on natural grazing as well as in the feedlot. Additionally the cattle have thick, pigmented skins covered with fine short hair of different mixtures of colour. The patterns have an attractive mirror image, which together with the variability in colour make the hides a valuable item suitable for niche marketing.

During a workshop on 'Community-Based Management of Animal Genetic Resources (CBMAnGR)' in Mbabane, Swaziland (see section *Community-based conservation of animals: The missing link* in Part 1), participants agreed to formulate an initiative for the development of a viable Nguni leather product industry to directly benefit resource-poor communities in South Africa.

To develop the hide industry, this initiative is collaborating with two rural development projects in South Africa, the South African Department of Agriculture and the Animal Improvement Institute with an existing project, which introduces market-quality Nguni bulls into local Nguni cattle herds and provides training on management and marketing. Other partners will include the Nguni Breeder's Society, which is planning a similar project, and the Eastern Cape Development Corporation. All these initiatives aim to add value to hides, which is expected to lead to the development of small and medium enterprises in the communities and to alleviate poverty.

The initiative proposes the following structure for developing the marketing potential and overcoming constraints. Different farmers' organisations and co-operations will be responsible for collecting and delivering hides and skins. Their members will be trained to prepare hides and skins for transport. A central umbrella organisation, which is envisioned to be a private marketing company, will receive the tanned hides and skins and market those of sufficient quality to the commercial market. A part of the earnings will be used to support the infrastructure of the central organisation; the remainder will be equally shared amongst the suppliers of the hides and skins. The communities will buy back the unsold hides and skins from the central organisation. The first step of this initiative is to evaluate the potential market for on-hair hide and hides tanned for ordinary purposes. Is there a national market (furniture industry, curios) or even an international market (car industry)? Are small tanneries able to deliver high-quality hides? Which arrangements are possible to involve large-scale tanneries?

The initiative hopes that the process just outlined will ensure true community benefits while avoiding some of the more obvious constraints such as low production volume and monopolies. As an initial step the project has initiated a study to assess the market potential of Nguni hides and the feasibility of developing this potential. Depending on the results, the above structure will be modified and alternatives elaborated.

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Chiapas sheep: Crossbreeding failures and a participatory breed improvement programme

In the 16th century when Spanish monks and colonists arrived in Latin America, they brought along various sheep breeds, such as the Spanish Churra, Manchega, Lacha and Castellana, none of which were previously known in this region. In Chiapas, Mexico's southernmost state, Tzotzil women adopted some of the animals introduced by the Spanish. Over time the sheep and their wool became a part of Tzotzil culture and religion through a complete mixture of ancestral concepts and old Spanish herding practices. Eventually the sheep evolved into what is now known as the Chiapas sheep.

The Chiapas breed produces 1.2 kg of wool per year on average -- low compared to typical wool breeds such as Merino and Rambouillet which produce roughly eight times more. For this reason, extension services in the area have made several attempts to introduce exotic breeds to increase wool production. The first project started in 1973 when 800 Rambouillet rams were introduced into village flocks. This attempt was a disaster, since all the introduced animals died within a week. In 1977, a group of Columbia rams were introduced -- with the same aims and results. The introduction of the exotic breeds was not successful because they were not well adapted to the mountainous climate, low-quality forage and parasite infestation. Besides the interests and needs of Tzotzil women were totally different from those extension workers had envisioned. The women had problems handling the big sheep, which they considered as 'not obedient', and the women did not like the thin and long wool quality since it was unsuitable for hand weaving.

In 1981, a third crossbreeding attempt started with a large flock of Romney Marsh sheep, aiming to use crossbred rams of the second generation in the village flocks. There were many problems because the breeding seasons of the two breeds were not compatible. Furthermore, as the Romney sheep were adapting to the environment (and adapting to the Chiapas breeding season), they were also reducing their size and wool production considerably. The Romney project was abandoned in 1990. Probably one of the biggest mistakes was that the extension workers, mainly men, communicated only with Tzotzil men. But in Tzotzil society it is the women that are entirely responsible for sheep husbandry while men are engaged in agricultural work and paid labour in nearby cities.

The Institute of Indigenous Studies, a department of the University of Chiapas, has been taking a different approach. Its work with Tzotzil communities started in 1985. During the last ten years, the Institute has been implementing a genetic improvement programme aiming at the improvement of quantity and quality of wool production of the Chiapas sheep. A group of about 10 Tzotzil women participates every six months in evaluating fleece quality at the university's sheep farm. The selection of superior sheep is based on these women's criteria. They include colour and cleanliness of the fleece, volume and length of the wool, suitability for processing, and size and character of the animals.

The selected sheep are taken to the university farm where they produce offspring of the 'improved Chiapas sheep'. Out of these, the rams undergo a two-year evaluation programme for their fleece. Based on the records of four shearing seasons, superior animals are identified and assigned to the communities. The selection programme has resulted in significant increases in quality and quantity of wool. At the university

farm, selected rams produce wool twice as much as village rams of similar age and under similar management. Up to date the acceptance of the 'improved Chiapas sheep' by the Tzotzil women is high because the animals commonly adapt to local conditions within three days and Tzotzil women are involved throughout all project phases. The Institute's participatory work with the Tzotzil women has resulted in a process of mutual understanding and learning.

Source:

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Part 3. Selected papers

Implementing the Convention on Biodiversity with respect to domestic animal diversity[1]

by Ilse Köhler-Rollefson

Background

The FAO (FAO, 1999; FAO/UNEP, 1995) is alerting the global community to the alarming figures in respect to domestic animal diversity. It estimates that about one third of the world's recognized 5000 livestock and poultry breeds are endangered and that breeds become extinct at the rate of one per week. Nevertheless, the subject has received much less attention than plant genetic diversity and hardly any awareness appears to exist about the problem of animal genetic resource erosion among either donor agencies or among NGOs and groups at the grassroots level. Contrary to the situation with plant genetic resources, approaches for participatory conservation are lacking, although the majority of the threatened Animal Genetic Resources (AnGR) are vested with traditional pastoralist and farmer communities. Domestic animal diversity is an outcome of these very diverse ethnic and social groups managing domesticated animal populations in a wide variety of habitats and manipulating their genetic composition according to their own needs, cultural preferences, indigenous knowledge and ecological conditions.

The reasons why indigenous breeds become extinct are manifold. Factors include replacement or cross-breeding with exotic breeds, alienation of common property resources (due to break-down of traditional management institutions, crop cultivation, irrigation projects, wildlife protection, tourism, etc.), political conflicts (land disputes and wars), natural disasters (droughts, floods, cyclones), technological advances (replacement of work animals by machines), integration into the global economy, unfavourable marketing and policy environments for local livestock products, and others.

Article 8 of the UN Convention on Biological Diversity states that genetic resources should be conserved in the 'surroundings where they have developed their distinct properties' – which, with respect to livestock is a reference to the farming and pastoral communities that have nurtured local breeds. Furthermore, the CBD spells out that 'the knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity are respected, preserved and maintained'. Clearly, the spirit of the CBD calls for a participatory approach to animal genetic resource conservation.

Formal Research on Animal Genetic Resources and the CBD

Let us now look at the activities and approaches of the two international institutions that have shouldered responsibility for finding solutions to the problem of animal genetic resource erosion, in the light of the provisions made in the CBD.

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FAO

The Food and Agriculture Organization has been given a world mandate to study, advise, and set guidelines on conserving livestock genetic resources for present and future food security. A core activity of FAO's Initiative for Domestic Animal Diversity (DAD) is the establishment of a database to inventory and monitor AnGR resources worldwide - the DAD Information System or DAD-IS (http://www.fao.org/dad-is). Designated national coordinators in FAO member countries provide the information that is entered into DAD-IS. They characterize breeds according to their production characteristics and population size. The former include milk yield, lactation length, milk fat, litter size, birth weight, adult weight, and adult wither height. Population data recorded in DAD-IS include total population size, total number of females bred, total number of males used for breeding, etc. Up to date more than 5000 livestock and poultry breeds have been registered in DAD-IS. Currently, documentation is further being refined with individual countries compiling national status reports.

Going beyond documentation, the FAO Initiative is also involved in capacity building for achieving conservation of those breeds classified in the database as endangered and critical. Another task is to promote sharing of precious genetic resources as well as free access to this global 'public good'. To achieve this, the Initiative has set up an intergovernmental mechanism, a technical programme of management support for countries, a cadre of experts, and a country-based global infrastructure of national coordinators. Accepting that it will neither be possible nor even desirable to save the large number of recognized breeds, the FAO has invested heavily into a project of establishing genetic distances between the breeds of various species. The aim is to identify those breeds that are taxonomically most distinct and should therefore be prioritised for conservation (Barker, 1999).

The FAO has commissioned an expertise on the implications of the CBD for the management of animal genetic resources and the conservation of domestic animal diversity (Strauss, 1994). It makes the point that 'the indigenous knowledge that has helped to produce and maintain domestic animal diversity is largely unexplored and yet this knowledge is essential in order to understand and continue developing these animal genetic resources.' (FAO n. d.).

ILRI

Activities at the International livestock Research Institute in Addis Ababa also focus on genetics at the molecular level such as establishment of a phylogenetic tree for cattle breeds of Africa and Asia and mapping of genetic traits. Again, these efforts are undertaken with an eye on identifying those genetic resources that are most worthy of being saved. ILRI makes no reference to the CBD (mention of which is also notably absent in the New Vision and Strategy of the CGIAR 2000). In its breed survey questionnaire it however asks for certain information on 'adaptive and unique attributes' to be supplied from the Indigenous Knowledge of Farmers.

ILRI has made the following public goods available according to information presented at its website (http://www.cgiar.org/ilri/products):

- A database on the distribution and physical performance characteristics of African cattle, sheep and goats
- A phylogenetic tree for cattle breeds of Africa and Asia
- Methods for determining ruminant breeds at risk of extinction
- A reference herd of N'Dama-Boran crossbred cattle serving as an international Resource for a global project to develop a primary genetic map of cattle

- The first mapping of quantitative trait loci controlling resistance to haemo-parasitic disease of major economic importance (animal trypanosomiasis)
- A set of genetic markers disclosing superior disease (trypanosomiasis)-resistant animals for use in livestock breeding programmes.

Omission of Indigenous Knowledge

The data collection strategies and databases of both institutions are geared towards the needs of scientists and representatives of government institutions. Rooted in formal scientific concepts and values, they are not designed to integrate and make use of indigenous knowledge. This results in an incomplete picture of the actual situation on the ground that could interfere with conservation efforts.

- Stock raisers and scientists use different terminologies and categories when referring to local livestock breeds. Farmers' breed classification systems may be more refined than the latter, indicating the existence of breeds that have escaped scientific attention. For instance, scientists opine that India's donkey population has not diversified into breeds, but local donkey experts distinguish at least three, phenotypically quite distinct types of donkey that hail from three different areas - making them, in all probability, three breeds or at least strains. Similarly, pastoralists had long known a camel breed from India with high milk-production potential before it was reported scientifically for the first time (Köhler-Rollefson and Rathore 1995).

- Stock raisers evaluate breeds differently than scientists. Whereas the latter are chiefly interested in documenting the output per single production cycle (under optimal husbandry conditions), feed and system efficiency is of greater relevance to farmers who raise animals under severe environmental constraints and have to cope with seasonal shortcomings in fodder supply. In addition, many breeds are appreciated for characteristics that have little to do with productivity, such as ritual significance, social role and aesthetic aspects.

- Population data that are based on scientific breed concepts and do not draw on local breed definitions and terminologies can be misleading. This is illustrated by the case of the Tharparkar cattle in India where no agreement obtains among scientists about which animals are to be subsumed under this category. Some scientists count the entire cattle population (several tens of thousands of head) in the two districts of India where it occurs (or once occurred), while others consider only the couple of hundred animals kept on state breeding forms as 'true Tharparkar'. Local people on the other hand do not know what 'Tharparkar' means and instead refer to it as 'Sindhan' (Köhler- Rollefson 2000).

As the FAO acknowledges, the sustainable management of AnGR is only feasible with the active participation of farmers and pastoralists. 'The most rational and sustainable way to conserve animal genetic resources is to ensure that locally adapted breeds remain a functional part of production systems' (FAO, 1999). Adoption of local categories and understanding of local institutions for managing AnGR resources would be a prerequisite for the development of such participatory approaches.

Furthermore, omission of indigenous knowledge and perspectives results in an evaluation of animal breeds on the basis of their outputs of cash products only. It is exactly the conception of animals as commodity producing machines while ignoring other vital traits that has been a prime mover in genetic resource erosion. On the other hand, domestic animal diversity in the South has evolved precisely because its

people and cultures relate to animals in a different manner and accord them variable social status and ceremonial roles.

Hence reducing animals to gene sequences is neither legitimate nor will it serve the purpose of conserving domestic animal diversity. We must bear in mind that it was farmers and pastoralists who have created domestic animal diversity by subjecting animal populations to diverse cultural and ecological regimes. Scientifically designed manipulations of gene pools such as artificial insemination, embryo-transplantation, and now cloning on the other hand have invariably resulted in genetic homo-genisation. (That this can have positive effects is not disputed here, but represents an entirely different matter).

Setting priorities for breed conservation via molecular genetic techniques is a scientific shortcut that ignores the human dimensions of domestic animal resources. It would seem much more urgent and appropriate to establish a dialogue with the ethnic groups and communities that are associated or have co-evolved with the respective breeds[a]. Understanding of their needs, priorities and attitudes should form the basis for developing conservation strategies. Science alone can not be expected to conserve DAD, nor will in-situ conservation on government farms and standardized husbandry conditions suffice. Instead, we need to foster as large a diversity of approaches to conservation as possible by getting rural development NGOs, pastoralist associations and others into the picture!

Value of Local Breeds

One important factor driving the process of animal genetic resource erosion is lack of confidence in the value of local breeds. For decades, southern livestock breeds were a priori regarded as less productive than their northern counterparts. Furthermore, it was believed that genetic improvement by selection within the breed was too time-consuming to be worthwhile; hence all energies were spent on attempting a quick fix by crossbreeding. There is now increasing evidence that local breeds may not only be superior, but also that their productivity can be further improved within reasonable time frames. One example concerns the various zebu cattle breeds (including Ongole, Gir, Kankrei) that were exported from India to Brazil, Australia and other countries earlier this century. In their new homes they have been improved on genetically and come to represent prime beef or dual purpose producers, whereas the Indian populations have decreased in number, become diluted due to cross-breeding and in some cases are regarded as threatened. Some private initiatives in India, such as that by the Gir cattle-breeding farm of the Shri Bhuvaneshwari Pith in Gujarat, show that considerable improvements in milk production can also be achieved. Examples where efforts to replace local breeds with imported ones were reversed include

- The lndo-Swiss goat project in Rajasthan initially tried to popularise crossbreeding of local goats with Swiss breeds but then came to the conclusion that the native Sirohi goat was superior in many ways (Kropf et al., 1992).

- In Mexico, the Criollo pig was almost replaced by imported white pigs despite its usefulness for smallholders, its ability to make use of local feed and its better taste (Anderson et al., 1999).

[a] Not all breeds are associated with particular communities; many of them are composite breeds - the results of scientific efforts to create new breeds, but local farmers never adapted that. It is questionable to what extent they need to be conserved.

- From South Africa there is the case of the Nguni cattle, which is disease resistant and can thrive on poor pastures. The government upgraded this breed by crossbreeding with European breeds but the improved animals also required much higher inputs, which became unaffordable to small farmers. Now there are efforts to re-supply farmers with Nguni cattle whose population has decreased (Blench, 1999).

Stock Raisers Rights

So far there have been no efforts to give credit to stock raisers for their role in nurturing domestic animal diversity, in tune with the concept of 'Farmers Rights'. This may in part be due to the fact that the significance of indigenous knowledge and institutions in breed formation processes has not yet filtered into general awareness. Animal scientists subscribe to the opinion that local livestock breeds have evolved only in response to ecological conditions without any intellectual inputs by pastoralists or farmers. Documentation of indigenous institutions and practices of animal genetic resource management is hence of crucial importance.

Unfortunately this has not yet happened, although the NGO initiative in India to establish People's Biodiversity Registers provides some valuable pointers. Its intention is to protect people's rights to their intellectual property and natural resources by building an open and transparent system on biodiversity resources from village level upwards (Utkarsh, 2000). It is urgent to extend a similar approach to pastoralists' and farmers' knowledge on domestic animal resources as well, since it is quite likely that the indigenous breeds from the South that currently receive little appreciation may at some stage in the not so distant future be in great demand in the North as well.

Northern high performance livestock is dangerously inbred and has lost many of its fitness traits. For instance, modern chicken strains are no longer able to hatch their young, because brooding behaviour is no longer present. Turkeys and certain pig breeds often can not mate naturally because of heavily developed chest and thigh muscles respectively and depend on artificial insemination for their reproduction. German cows only survive for an average of 2.7 lactation cycles. Farmers who want to raise poultry under natural conditions outside factory forming systems face problems of finding chicken that con survive outside cages.

To ensure at least a modicum of fitness and vitality in future populations of food-producing animals, and to keep genetic options open, access to fresh genetic material will therefore always be required. Since most of the wild relatives of today's domesticated animals are extinct, a major source of such material lies with the livestock raised by herders and farmers under extensive, subsistence-oriented production systems in the South. This is already being utilized for such purposes by northern livestock industries. In 1990 Australia imported embryos of 269 Tuli and 264 Boron cattle from Zimbabwe and Zambia to improve its Friesian stock in regards to fertility, docility and environmental stress resistance. These imports were hailed as saviours of the northern Australian cattle industry (RAFI/UNDP, n.d.). The threatened N'dama cattle were used to create a new hardy, disease resistant breed called Senapol that is now raised in the southern US.

The danger of big corporations' free-for-all bio-prospecting among indigenous genetic resources is definitely real. As a recent paper on swine genetics recounts, 'Some genotypes formerly not among the ones of economic interest for the industry became targets of the breeding companies' research programs which aimed at discovering and transferring specific genes from these genotypes to the industrial genetic lines.

This is for example the case with the highly prolific Chinese breeds and the Iberian pig with excellent meat quality for production of extensively cured pork products' (Pereira et al. 1998).

Given that the stock breeding industry zealously guards and patents their own genetic materials, there is a moral imperative to extend similar protections to traditional stock raisers and breeders - although, granted, this will be no easy task.

Conclusions

Currently few benefits seem to percolate down to pastoral and forming communities from AnGR related activities currently pursued by formal sector international and national institutions. Agendas are pursued predominantly from the so-called "genetic resource angle' that seeks to save or rescue breeds in their role as carriers of genetic material that might have some economic potential in the future and could be valuable for humanity at large. While the important role of many indigenous breeds in sustaining rural livelihoods is also highlighted by the FAO, the existing strategies are insufficient for supporting and facilitating sustainable management of AnGR by farmers and pastoralists. We must be aware that extinction of a breed is often the outward symptom of an existential crisis experienced by the people who previously depended on it. Many breeds can best be saved by supporting the associated communities in their livelihoods through appropriate policies, such as those that ensure access to pastures and markets.

In order to conserve domestic animal diversity in the South in line with the stipulations of the Convention on Biodiversity, activities must be expanded to include the following strategies:

- Documentation of the local/indigenous institutions, breeding practices, and cultures of the peoples who nurtured and shaped so many hardy livestock breeds.
- Decentralization of activities to involve stock raisers themselves in on-the- ground conservation. Pastoralists with their long history of co-evolution often have a culturally highly developed sense of guardianship, partnership, or even personhood vis-à-vis their animals. This heritage should make them the lead actors in conservation efforts.
- Ensuring that the specific ethnic groups and societies receive benefit from sharing the unique genetic resources they have created.
- Adoption of a more comprehensive sustainable livelihood approach to- wards conservation by instituting policies and programmes that secure access to pasture and animal health care and create a level playing field for the marketing of the products of local breeds.
- Information for pastoralists and breeders organizations about the rights they have been accorded in countries that are signatories to the CBD
- Capacity building of NGOs to take up roles as intermediary actors between governments/ research institutions on one hand and farmers/pastoralists on the other.

In summary, it is both technically and ethically imperative to open channels of communication with stock raisers and to institute mechanisms for reaching the grassroots groups - those who have shaped and stewarded different breeds down through the centuries and who stand to lose the most if these unique resources disappear from the fact of the earth. In order to successfully implement the Convention on Biodiversity, a close integration of the activities of all stakeholders - researchers, governments, civil society, but especially livestock keepers and

pastoralists - is absolutely essential and steps towards this goal should be taken without further delay.

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Tab. 1: Numbers of breeds of the major livestock species recorded in the FAO Global databank for Animal Genetic Resources, and the numbers estimated to be of risk (source: R. M. Blench, 1999)

Species	Recorded	At risk	At risk %
Donkey	77	9	37.5
Buffalo	72	2	3.6
Cattle	787	135	23.2
Goat	351	44	16.5
Horse	384	120	43.3
Pig	353	69	26.0
Sheep	920	119	18.1
Yak	6	0	0
Dromedary	50	2	4.0
Bacteria camel	7	1	14.3
Alpaca	4	0	0
llama	4	0	0
Guinea-pig	?	?	?
Duck	62	29	46.8
Turkey	31	11	35.5
Chicken	606	274	45.2
Muscovite duck	14	5	35.7
Goose	59	28	47.5
Guinea-fowl	22	4	18.2
Quail	24	16	66.7
Pigeon	19	4	21.1
Total	**3851**	**872**	**22.6**

Tab. 2: Livestock breeds at risk by region (source: R.M. Blench 1999)

Region	Recorded	At risk	At risk %
Africa	396	27	6.8
Asia Pacific	996	105	10.5
Europe	1688	638	37.8
Near East	220	29	13.2
South-Central America	378	15	4.0
North America	204	59	28.9
World	3882	873	22.5

Africans manage livestock diversity[1]

by Constance McCorkle

After decades of development debacles with alien breeds, scientists and developers have at last come to appreciate the vast animal genetic resources that ordinary farmers and herders have developed through the ages, especially in the South. Today, all over the world, rural people keep about 4,500 breeds of domestic animals of more than 40 species. Based on a global overview of ethnoveterinary literature (Martin et al., forthcoming), this article summarises some findings on the local knowledge, management, and use of livestock diversity that has made possible the development and maintenance of 'living gene banks' of special animal breeds in Africa.

As many as 150 reported varieties of cattle, 60 of sheep, and 50 of goats are currently found in Africa. There is also considerable (but less well documented) biodiversity in horses, donkeys, mules, chickens, pigs, and dromedary camels.

Stock records

African stockraisers typically have a rich knowledge of multiple aspects of animal husbandry, including a practical, working knowledge of genetics. Many pastoral and agropastoral peoples keep detailed mental or oral livestock stock records. Indeed, any 10-year-old child of the Bororo pastoralists of Niger can easily identify the pedigrees of all the animals in his/her own and nearby families' herds. This is because an animal's ancestry is typically encoded in its name, and names are never changed when animals are sold or exchanged. Like the Bororo, Twareg herders of the Sahara Desert keep close track of their camels' pedigrees via permanent names for individual animals. These names reflect maternal ancestry. Rashaida camel breeders trace their racing and riding animals' pedigrees back at least seven generations.

Traditional institutions

Throughout Africa, stockraising peoples have indigenous social institutions for sharing, lending, or exchanging breedstock. For example, the Sebei in Uganda practice *namanya*, in which households may borrow or exchange a heifer in a contract that can extend over three generations. In this arrangement, the recipient family cares for the heifer in return for her first-born plus the use of all the milk from her and her progeny. At the contract's conclusion, an equivalent animal is returned to the donor household. While Sebei explanations for namanya centre on social, charitable, and labour-saving concerns, and on spreading the risk of losing animals, this mechanism has the added benefit of bringing fresh blood into family herds. For this latter purpose, Samburu and Turkana pastoralists of Kenya form 'stock friendships' in which friends exchange animals. For at least 150 years, Lesothans and Western Zambians have used a similar institution, *mafisa*, expressly for genetically improving their cattle. They place a number of their cows in the herd of another family with superior bulls. After several years, the cows and their progeny return home; but in the meantime, in recompense for the stud services rendered and the cows' care, the host family enjoys the use of the milk.

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Stockraiser logic

Virtually every long-time stockraising society has developed one or more distinct livestock breeds to suit its particular environment and animal-product needs. People often have multiple breeding goals for a given species, however. Still, the first consideration is sheer survivability. A number of overarching selection criteria can be identified in this regard, of which disease resistance is perhaps the most salient.

For example, eastern and southern Africans have developed the Sanga family of cattle, which are resistant to a major infectious disease, East Coast Fever, and to the ticks that carry it. Similarly, West Africans have developed many dwarf breeds of cattle, sheep, and goats that resist blood parasites and other common diseases. And whenever Fulani pastoralists of the Sahel migrate into a new area, they always buy some local bulls and rams with the express purpose of enhancing their herds' adaptation to local diseases and other stresses.

Another critical breeding criterion is adaptation to conditions such as temperature, insolation, precipitation and mineral resources. Even seemingly simple features like coat and skin colour may be important in such regards. It is probably no accident that Bunaji cattle, developed by the Nigerian Fulani, have a pure-white coat and a black skin. These characteristics allow Bunaji to graze under far higher ambient temperatures than European cattle.

Other common criteria for selection are the ability to walk long distances in search of water, to resist periods of water and forage scarcity, and to be a good mother. The latter includes battling predators on behalf of progeny, paying close attention to new-borns and weaklings and, in poultry, devoted brooding.

Additional selection criteria relate to animals' particular production roles. An example is the D'Man sheep of Morocco. Developed by oasis dwellers as a meat animal, D'Man frequently produces twins, triplets, quadruplets, and even quintuplets. On the other hand, Somali pastoralists have developed a non-twinning dairy goat breed so as to ensure more milk offtake for human, rather than kid, consumption.

Religion and animal selection

Religious and cultural considerations also figure in stockraisers' development or maintenance of special strains or types of animals. For instance, Nigerian Hausa keep some unique types and colours of naked-neck and frizzle-feathered chickens because these birds are associated with spirits in local Bori rituals. Along with behavioural traits such as fierceness and good mothering, these physical qualities are required for the proper performance of rituals in which the birds are sacrificed to the Bori spirits. Apart from these religious considerations, many of the same qualities improve survival rates and production in Africans' free-range systems of poultry management.

Similarly, Bodi agropastoralists of Ethiopia carefully breed cattle of many coat colours, with whom people identify themselves. "These animals are imperative for certain rituals and are indispensable to the Bodi society. Without such coat colours, it is doubtful that the Bodi could exist socially and culturally" (Fukui 1988).

Indeed, keeping genetic variability on tap is a wise long-term hedge against changing circumstance and need. As some of the foregoing examples have illustrated, local breeds and breeding strategies are not static and unchanging. Africans continue to adapt and refine their animal breeding today. At the same time, people endeavour to maintain traditionally prized traits and beloved breeds. But their efforts are under attack from many sides.

Threats to livestock biodiversity

Nearly a third of the world’s livestock breeds are currently at risk of disappearing, and the extinction rate now stands at about six breeds per month (NAO 1998). Even among Africa's nine traditional cattle breeds with resistance to blood parasites, all but

three are endangered. A dismaying number of African breeds of sheep, horses, donkeys, and poultry as well as cattle have already gone extinct. This erosion in domestic animal varieties is all the more frightening when compared to cultivated plant species, which enjoy far greater genetic variation and which have many more surviving relatives in the wild.

Failure to pay greater attention to stockraisers' efforts to maintain animal biodiversity is foolish in the face of recent research suggesting that, overall, indigenous breeds can be as, if not more, productive than imported ones. It is ironic that wider appreciation of local breeds has been accompanied by the realisation that this treasure trove of biodiversity is under attack by poorly thought-out 'scientific' methods of animal production and reproduction, and by market-oriented approaches to development.

According to some analysts, northern veterinary medicine has contributed to local breeds' genetic deterioration or near-disappearance. Veterinary extension efforts can weaken a hardy gene pool by keeping sickly and deformed animals alive until mating age. Veterinary medicine has also been implicated in the extinction of local livestock varieties on the grounds of disease eradication.

An instructive case is Operation Coq, a nation-wide program instituted in the 1970s in Nigeria. Northern or northern-trained veterinarians claimed that village birds were heavily disease-ridden and thus low-producing. The goal was to substitute all local cocks with exotics. Needless to say, Operation Coq was a resounding failure. The alien cocks could not compete with the hens' indigenous suitors. Indeed, they could not even survive village climatic and husbandry conditions.

Whether in Africa or elsewhere, a growing number of researchers blame the decline in livestock biodiversity on the high-risk, cash-based economies of the modern world. Traditionally, pastoralists exchanged livestock goods (meat, milk) and services (manuring, field clearing) for staple foodgrains from cultivators. The terms of trade in such transactions were much more equitable than those of the modern marketplace. Moreover, they were often flexible, such that herders, as well as farmers, were cushioned against lean years.

But nowadays, stockraising peoples *en masse* may find themselves obliged to sell off their best animals just in order to obtain cash to buy foodgrain. This can leave whole ethnic populations of stockraisers with only inferior breedstock or with too few animals to continue in their profession. And when prime, young breedstock and even entire herds of unique breeds are sold for slaughter, their special genetic qualities may be lost forever.

In fairness, it should be noted that pressures to abandon indigenous breeds have not emanated solely from scientists and developers. Invading and colonising powers have been at work too. Such groups tend to prefer animals whose management and productive characteristics are already familiar to them. The military and cultural conquests of Islam, for example, have led to the repression of some local herd-animal breeds in favour of ones deemed 'better' in Islamic views.

Careful analysis

For whatever reasons, the literature indicates that fewer and fewer stockraising peoples are able to maintain their traditional breeds or to cleave to their social institutions and cultural rules for mating, exchanging, and selling animals. Indeed, many are unable even to remain in their profession. The result is a concomitant loss in the knowledge and existence of the livestock biodiversity that people have so long husbanded.

Thus, any proposed interventions in people's management of livestock must first be carefully analysed in the context of interlocking - or sometimes competing - production and marketing systems, as well as the logic behind people's keeping certain species and breeds. This includes the social, cultural, and spiritual values of the animals for their keepers' families. At the same time, interventions must be

considered in terms of the benefit to all humans of keeping these 'living gene banks' alive, along with the peoples who develop and manage them.

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African cattle genetic resources: Their unique attributes and conservation through utilization for milk production[1]

by: Alexander Kahi and Edward Rege

Introduction

Different hereditary characteristics of breeds and even types within a breed have resulted in differences in reactions to environmental stimuli. These reactions are intimately associated with anatomical-physiological characteristics, which have developed as a result of natural selection. Sub-Saharan Africa is the home of roughly over 150 indigenous cattle breeds (Rege, 1999). Indigenous African cattle have been identified with a particular area or people from time immemorial and are thus adapted to local environmental stresses and they posses certain desirable characteristics.

Ensuring that locally adapted breeds are a functional part of production systems is the most rational and sustainable way to conserve animal genetic resources. This can only be possible if sustainable breeding strategies for such animals are developed which take into account their economically important and unique attributes. African cattle genetic resources are owned by small-scale farmers and pastoralists for whom they are a source for improved nutrition, income and a secure form of investment. Their conservation, therefore, should be through utilization if they are to be of any benefit to these farmers and pastoralists. This discussion will focus on five very pertinent questions that need to be answered if the conservation of African cattle genetic resources is to be effective and sustainable: What, why and how should we conserve? and who are the stakeholders and what are their roles in conservation efforts?

Classification of the African cattle

The original African cattle can be divided into two major categories, namely humpless (*Bos taurus*) and humped (*B. indicus*). The former category is subdivided further into longhorn (*B. taurus longifrons*) and shorthorn (*B. taurus brachyceros*), while the latter category is subdivided into zebu proper and zebu crossbred-types. Position of the hump on the animal's back is one of the criteria used to classify the zebu proper and zebu crossbred-types into cervico-thoracic-humped (sanga) and thoracic-humped stocks (Epstein, 1971). The sanga is nowadays considered a separate group of cattle. As per the current classification of African cattle, four different groups can be distinguished namely *B. taurus, B. indicus*, sanga and sanga x zebu types. The latter group has been termed 'zenga' by Rege (1999). Additionally, there are more recent derivatives of African cattle; these have either resulted due to the close proximity of two or more indigenous populations, or from efforts to create composite commercial breeds. Rege (1999), and Rege and Tawah (1999) give clear examples of each of these groups in Africa.

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Unique attributes and properties of African cattle

Disease resistance or tolerance

Trypanosomosis. Trypanotolerance in cattle particularly in the N'Dama (a West African Longhorn) is well documented (FAO, 1980). Other documented trypanotolerant cattle breeds in sub-Saharan Africa include an estimated 15 hornless Shorthorn breeds found in West Africa (14) and Eastern Africa (only one, the Sheko) (Rege et al., 1994; Rege, 1999). In high-risk areas most *B. indicus* breeds require regular treatment. However significant differences in resistance to trypanosomosis occur also among various *B. indicus* breeds (Njogu et al., 1985).

Endoparasites. Surprisingly, evidence for host genetic resistance to gastro-intestinal nematodes of African breeds (Frisch and O'Neill, 1998) is from Australia. It has generally been observed that *B. indicus* cattle are more resistant to gastro-intestinal nematode parasites than European *B. taurus* cattle (Frisch and Vercoe, 1984). Comparison of beef cattle breeds of African, European and Indian origins by Frisch and O'Neill (1998) showed that the Brahman (Indian Zebu) was more resistant to gastro-intestinal nematodes than the Boran (African Zebu). Among the two African breeds represented in that study i.e. the Boran and the Tuli, the Boran had higher resistance to worms than the Tuli.

Ectoparasites. The most important ectoparasite that imposes severe constraints on livestock industries in sub-Saharan Africa is the tick. While the indigenous cattle breeds are resistant to ticks, it has been established in the Zebu cattle of southern Uganda that it's resistance to some tick species, *Rhipicephalus appendiculatus* in particular, is not strong (Kaiser et al., 1982). An evaluation of the performance of indigenous Nguni, Bonsmara and Hereford in South Africa indicated that the Nguni was more resistant, the Bonsmara being intermediate (Fivaz and Waal, 1993). In Ethiopia, the Boran, Barka and Horro indigenous breeds have been shown to be more resistant to ticks than their crosses with the Jersey, Friesian and Simmental breeds (Yehulashet et al., 1995). Partial tolerance to theileriosis (East Coast Fever) in the Ankole cattle in Burundi (Kiltz and Hurnke, 1986) and in Rwanda (Paling et al., 1991) have been reported. This tolerance is likely to be a result of centuries of natural selection within the Ankole cattle population, surviving in the East Coast Fever endemic areas of East and Central Africa.

Heat tolerance

Heat tolerance is one of the adaptations which contribute to the performance of tropically derived breeds and their crosses in warm environments (Turner, 1984). In Nigeria, Amakiri and Funsho (1979) studied the rectal temperature and respiratory rates of German Brown, Friesian, German Brown/Friesian crosses, N'Dama, White Fulani and German Brown/N'Dama crosses and showed that the Friesian and German Brown were less heat tolerant than the indigenous N'Dama and White Fulani. Use of the sweating rate as an indicator of heat tolerance indicated that the White Fulani and N'Daina breeds were similar in heat tolerance (Amakiri and Onwuka, 1980). The superior heat tolerance of the indigenous breeds has been attributed to their coat type and colour, skin thickness and pigmentation, high sweating capacity (which is a measure of the density of sweat glands in the skin), low body heat production as a consequence of their low productivity, body conformation (e.g. have fat localised in specific areas of the body) and some physiological aspects.

Adaptation and nutrition

While comparative studies of indigenous livestock breeds with their exotic counterparts are lacking in sub-Saharan Africa, it has been shown that indigenous Zebu (*B. indicus*) is better able to utilize lower quality feeds than the temperate

breeds. It has been suggested that the superiority of the *B. indicus* on low quality feeds could be due to their superior ability to recycle endogenous nitrogen in the rumen (Hunter and Siebert, 1985b). Zebus also have higher true digestibility, more extensive ruminal digestion, more efficient protein synthesis and lower metabolic faecal nitrogen excretion than most temperate breeds (Hunter and Siebert, 1985a and b).

Conservation options for efficient milk production

Conservation activities can take two basic forms, namely: *in situ* conservation and *ex situ* conservation. This paper will deal with *in situ* conservation which involves the maintenance of live animal breeding populations to ensure their continued contribution to sustainable food and agricultural production, now and in the future. Integration of utilization and development in any conservation efforts will ensure that animal genetic resources are managed in a manner that maintains future options. African genetic resources can be productive if African countries take cognisance of their potential by running a selection programme which utilizes an open nucleus system. Smith (1988) and Bondoc and Smith (1993) have described the methodology of open nucleus breeding schemes applicable for the specific situation in developing countries. Options for *in situ* conservation (through utilization for milk production) of African cattle are presented under five scenarios which consider the matching of genotypes with environments:

1. In the long run, under climatic conditions of high altitude, exotic European breeds and high grades will, most likely, predominate

Continuous use of exotic germplasm will lead to an increasingly higher proportion of exotic blood. Crossbreeding results in superior overall performance. However, if crossbreeding is indiscriminate and uncontrolled, this might result in reduced productive advantage and is a threat to African cattle genetic resources. In the starting phases of a crossbreeding programme, the performance is always high due to the heterotic superiority of the first cross. Moreover initial introductions of exotics are usually associated with above-average management levels. Thereafter, if the programme is not checked, the productive advantage might be reduced either due to recombination loss that leads to breakdown of this superiority in subsequent generations or upgrading to high levels of exotic blood without changing the environment. This brings about the problem of insufficient adaptation, which is seen in the decline in performance. Genes from the African cattle will continue to disappear in the livestock industry in these areas. Cunningham and Syrstad (1987) reported a linear improvement in almost all performance traits up to the 50 % *B. taurus* inheritance. Beyond 50 %, there was a slight increase in calving interval, but no clear trend in the other traits. Madalena et al. (1990a and b) found increases in performance of all milk traits, reproductive and calf traits up to 62.5 % *B. taurus* inheritance, after which there was a decline. In a comprehensive review of 80 reports from Africa, Asia and Latin America, Rege (1998) reported an improvement in milk yield when the proportion of exotic blood increased from 0 to 50% and a constant level between 50% and 100% exotic inheritance. A similar trend was observed for age at first calving. The lactation length increased over the entire range of exotic grades, although with 'up-and-down swings'. For calving interval, the shortest were observed for animals with 50% exotic genes and were longer both for animals with lower or higher exotic inheritance.

2. In coastal and lowland areas, there is a need for dual-purpose cattle adapted to these environments

Starting with herders that have experience with crossbred cattle and are familiar with recording, a testing and selection scheme could be established aimed at creating a dual-purpose (meat and milk) synthetic population. Choice of the foundation breeds to be used in the formation of synthetic breeds should be based on performance under environmental conditions similar to those in which the synthetic breed will be maintained. At least six countries have invested large resources to develop synthetic breeds from crossbred foundations (McDowell et al., 1996). Because of its organisational simplicity, the synthetic breed strategy is the most realistic approach to utilising the advantage of crossbreeding in small-scale dairying (Syrstad, 1996) and to reducing the continued erosion of African cattle genetic resources. Recent analysis of data of crosses of Ayrshire, Brown Swiss, Friesian and Sahiwal cattle in the coastal lowland tropics of Kenya favoured the synthetic breed strategy (Kahi et al., 2000a and b).

3. In areas where exotic and high grades cannot produce efficiently, changes in markets and production conditions may result in some adapted genetic resources becoming unsuitable for continued use

There can be progressive substitution of an indigenous breed/strain with a more specialized and adapted one. For example, if the overall objective is to increase milk production, superior genes from the well known milking zebus of Africa (e.g. Nandi zebu, Kenana, Butana and even the Sahiwal) could be introduced by using bulls from these breeds in a nucleus having cows belonging to the group which is to be replaced to produce halfbred bulls for natural mating in the field population. Continuous use of these bulls in the population would lead to a cow population with 50% of genes from milk zebus. If the farmers accept the performance of these crossbred cows, then crossbred cows from the field population can be screened and introduced into the nucleus. The bulls used in the nucleus would continue to be purebred milk zebu and this would result in the cows in the field population moving gradually to 100% new genes.

4. Grazing and some form of ranching based on adapted genetic resources will be one of the alternatives of animal farming in coastal and lowland areas

A good starting point is a purebred stud of the indigenous cattle breed in question. Based on this as a nucleus, a purebred selection scheme could be established on the principles of an open nucleus scheme. Such a scheme could be possible if it was run without physically relocating animals. Syrstad and Ruane (1998) have discussed how selection in indigenous *B. indicus* cows can be done using a small number of animals.

5. In marginal areas, pastoral communities with a transhumance or nomadic system based on mixed species (cattle, sheep and goats) but dependent on adapted genetic resources will exist for the foreseeable future

Socio-economic, logistical and infrastructural restrictions will probably continue to preclude possible establishment of any meaningful conservation programme under the conditions of pastoral and migratory communities. Cattle in these systems are milked and slaughtered for meat on special occasions. It is expected that, if any' there will be erratic and unpredictable requests for genetically improved bulls from the conservation efforts established under the conditions described in scenario 2 and 4. Pastoral herds represent a potentially important source of animals, which could be

screened at the start of the conservation efforts under scenarios 2 and 4. Conservation efforts involving pastoralists will only be successful when governments accept pastoralism as an integral part of their economic systems, and accordingly allocate resources for its development. Failure to involve pastoralists in inception and implementation of projects is a major factor contributing to the high rate of failure of projects designed for them.

Stakeholders and their potential roles in conservation efforts

Nucleus herd
The nucleus' main objective is the improvement and conservation of the indigenous population. The nucleus should also be involved in activities directly related to the animal owners e.g. extension advice, open days, demonstrations and in identifying with the local community. Performance and pedigree recording, and selection should be the major preoccupation of the nucleus. The nucleus should, through its extension agents and scientists, screen all the cows joining it from the participating herds. Nucleus herds should provide superior genes to the participating herds and encourage farmers to purchase their products through advertisement (e.g. marketing of breeding stock).

Participating herds (farmers)
Farmers own the animals and have responsibility for day-to-day decisions concerning the animals in their herds, i.e. feeding, health management etc. The farmers are clients as well as proprietors of the breeding programme.

Collaborators
National Agricultural Research Systems (NARS). These will be required in the early stages of development of breeding programme (e.g. to contribute to capacity building) and when this initiative is operational. They are expected to be in charge of the technical support required in the implementation and running of the programme. Their roles could include:

- Developing the programme and estimation of genetic parameters and economic values;
- Designing and evaluating the programme (including quantifying extent of genetic progress);
- Electronic data processing, genetic evaluation and breeding advice;
- Designing a system of mating and exchange of breeding animals between locations/herds;
- Training staff to work in the breeding programme;
- Ensuring participation and co-operation through extension and education; and
- Research and development.

Farmers' training centres and extension agents. Farmers' training centres should train the farmers in aspects of animal production and health and not just in genetic improvement. Farmers should be aware of what genetic change can achieve and how this can occur. Training of farmers is the responsibility of extension agents who should be able, with the help of researchers, to translate research information into simple terms for the farmers to understand. The extension agent is the contact person for the farmer in relation to improvement of animal production.

Breed societies. Breed societies for most cattle breeds in Africa are absent and this might in part be due to the absence of well defined breeding programmes for these

breeds. Breed societies generally co-ordinate the breeding activities between locations. Their other roles include:

- Registration of animals based on set breed standards;
- Maintaining national records for registered animals as deemed necessary;
- Designing programmes to promote and protect the purity of the breed consistent with the set standards;
- Promoting interest, spreading knowledge and supporting responsible breeding;
- Educating members and the general public about proper care, maintenance and treatment of the breed; and
- Funding research work aimed at improving, protecting, preserving and promoting the breed.

Co-operatives. Through community-based collective efforts or co-operatives, farmers create their own infrastructure of marketing and production support services e.g. services in animal breeding, health care, feed, other inputs and credit facilities.

Consumers. Consumers drive the programme in that they encourage the breeders and producers to focus the programme in ways that reflect the market (consumer) demand. Consumers also influence the breeding traits through their preferences and purchasing power. For example, if consumers prefer butter or cheese and are ready to pay high prices for them, the breeding programmes must be adjusted accordingly to reflect these preferences.

Policy and planning developers. This group should create an enabling environment in responding to consumer and farmer needs. The government, through some of its departments, and with the help of NARS would have to act as a regulatory body by developing animal breeding policies that ensure that the breeding programme is consistent with the overall national goals. This group should also provide the broad policy decisions required in planning, implementing and maintaining the breeding operation. It may be important to effectively involve farmers or farmer organisations in making these decisions. While farmers may not understand the technical aspects of the programme, they must be able to obtain practical interpretations associated with certain decision options.

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Food insecurity and industrial animal farming[1]

by Leah D Garcés

CONTENTS

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Report Summary

I. Introduction

Two-thirds of the world's livestock are found in developing countries[3]. Livestock operations in developing countries rely heavily on non-industrial, multi-purpose methods of animal agriculture. However, there is a new phenomenon for livestock production in developing countries: The Livestock Revolution. The so-called Livestock Revolution is characterised by a shift from livestock being kept for multiple purposes (hides, fibres, draught power, fertiliser, etc) and to supply food at a local level, to animals being raised under intensive methods to supply food at a global level.

Developing countries can expect to see a major transformation of how meat and animal products are produced within their countries[2]. Humane and sustainable farms will be out-competed and replaced by large-scale industrial farms. What's more, developing countries are expected to become the main producers of meat and animal products for the rest of the world. But what does this mean for developing countries and the individuals in these countries?

II. The importance of farm animals for small scale farmers

Most farmers in developing countries have mixed farms, where crops and animals are incorporated on a farm to create a relatively self-sustaining system. The multi-purpose, non-intensive methods of raising farm animals practised by farmers in developing countries play a critical role for livelihoods, culture and social status. Animals are used for a variety of purposes to create security for farming families in developing countries.

III. Replacing factory fanning with humane and sustainable agriculture

While small scale farming is mostly used by family farms in developing countries, it has the potential to really get food directly into people's mouths, factory farming has just the opposite potential: to take the food out of people's mouths. Access to the products of factory farming by poor people is limited because of a lack of money to buy the products. The products are more likely to be exported or end up in the hands of the more wealthy members of the developing countries. If helping to alleviate hunger and poverty is the goal, then humane and sustainable farms should be pursued.

A. The impact of factory farming on small-scale farmers

The western annual production industry is exporting a model of concentrated and exclusive markets to developing countries, which tends to put the small rural farmer out of business displacing them from their means of income.

At the individual level, many small farmers in developing countries find it impossible to compete with industrial scale production of farm animals and are forced to leave their farms in search of a new means of income. There are many examples that support the view that the introduction of industrial livestock rearing not only harms the rural individual farmer but also the so-called developing country.

Starting from as early as the 1970s, industrial animal rearing continues to increase in developing countries, concentrating in the hands of fewer and more national or multinational companies. This has resulted in displacing poor small farmers from their means of income through farm animal rearing. Poverty and hunger continue in these countries.

B. The Non-sustainability of Industrial Farm Animal Breeds

As some of the examples above show, the so-called Livestock Revolution often requires that developing countries import and use foreign breeds of farm animals. These farm animal breeds are often not well adapted to the climate, pests and parasites of developing countries, and need special care, without which they may suffer from poor welfare.

1. High concentrate feed requirements

Using industrial breeds of farm animals requires a developing country to import or grow additional feed to maintain the animal. Industrial farm animal breeds are not able to forage or receive crop or household residues and must consume these feed concentrates to meet their nutritional needs.

There is continuing controversy as to whether animals efficiently convert feed into energy for human consumption. While the issue of efficient protein and energy conversion may be exceedingly difficult to resolve, it is more clear to understand that producing food from industrial farm animals takes two steps and is therefore less efficient in terms of limited resources. First we must grow their food and then we must raise the animals.

2. Low genetic diversity

Past attempts at improving livestock productivity in developing countries have focused largely on the importation of exotic breeds.[32] Local farm animals in particular environments have developed resistance or adaptations to a full range of these environmental challenges. Industrial breeds of farm animals however are poorly adapted to climate, pests, parasites and diseases. Not only does industrial farm animal rearing promote poorly adapted breeds, but these breeds are often fragile, and may be unable to face environmental challenges due to low biodiversity amongst the breeds.

C. Putting things right: humane and sustainable animal agriculture in developing countries

The key to alleviating food insecurity in developing countries lies in humane and sustainable practices of farm animal rearing, as farm animals can play a crucial role in access to additional income and security. Successful sustainable farm animal agriculture in developing countries results when 'a social learning and participatory approach between projects and farmers'[18] and local technologies and practices are adopted. International development organisations must further recognise the crucial role that animals, when raised for all of their potentials in an extensive way, play in stabilising individual families in developing countries.

IV. Conclusion

There is an ever-pressing need for policy to prevent agribusiness from reaping private profits at the expense of developing countries' environment, genetic diversity, and poverty alleviation. Getting more individuals in developing countries involved with humane and sustainable farm animal rearing has great potential for alleviating hunger, while factory farming will almost certainly further the current hunger crisis.

FOOD INSECURITY AND INTENSIVE ANIM AIL FARMING

I. Introduction

Two-thirds of the world's livestock are found in developing countries.[3] Livestock operations in developing countries rely heavily on non-industrial, multi-purpose methods of animal agriculture.[4] However, researchers for the International Food Policy Research Institute (IFPRI), Food and Agriculture of the United Nations (FAO) and International Livestock Research Institute (ILRI) in their *Livestock to 2020*: *The Next Food Revolution* report, have recently collaborated to describe a new phenomenon for livestock production in developing countries: The Livestock Revolution. The so-called Livestock Revolution is characterised by a shift from livestock being kept for multiple purposes (hides, fibres, draught power, fertiliser, etc) and to supply food at a local level, to animals being raised under intensive methods to supply food at a global level.

World population is projected to increase to 7.7 billion by the year 2020, 95% of which is forecast to occur in developing countries. Demand for foods of animal origin is anticipated to increase at a faster rate than this population growth. According to this report, developing countries can expect to see a major transformation of how .meat and animal products are produced within their countries. Humane and sustainable farms will be out-competed and replaced by large-scale industrial farms. What's more, developing countries are expected to become the main producers of meat and animal products for the rest of the world. But what does this mean for developing countries and the individuals in these countries? As Janice Cox and Sari Varpama poignantly ask in their CIWF commissioned report, *The 'Livestock Revolution' Development or Destruction*?, is the Livestock Revolution a sign of development or is it a sign of destruction?

According to the UN Food and Agriculture Organisation (FAO), 800 million people in the world presently live without food security. Experts do agree that animal agriculture plays a key role in alleviating this hunger and poverty. However, they do not necessarily agree on what type of animal agriculture should be pursued. At a South African conference on food security in Africa, SHB Lebbie[2] stated that:

Animal agriculture is crucial to the enhancement of food security and sustainable agricultural development in Africa and in the rest of the 'developing' world. Livestock provide high quality food in the form of meat, milk and eggs. Above these, they contribute to food production through nutrient cycling and use of draught power for crop production; they provide opportunities for employment and earning cash income, they meet the socio-cultural needs of the people who keep them.

The Council for Agricultural Science and Technology (CAST) on the other hand refers to sustainable uses of livestock as 'indirect contributions of animals to food supply'[5]. They suggest in their study that technology and genetic engineering are the ‘quick fix' to poverty and hunger. However, as this report seeks to prove, sustainable animal rearing is one of the keys to alleviating hunger and poverty.

Most farmers in developing countries have mixed farms, where crops and animals are incorporated on a farm to create a relatively self-sustaining system. Globally, these mixed crop-livestock farms produce the largest quantities of animal products, surpassing industrial forms of production in every product except poultry meat and eggs. 59.8% of pig meat is produced by these extensive forms of rearing livestock as compared to 39.3% produced by industrial rneans.[6] While the proportion of industrially produced meat is still significantly high, the figures prove that by no means is mixed farming an *insignificant* method of food production. While poultry production

in industrial forms does surpass mixed farm production, small flock raising still plays a key role in the survival of many developing world farmers. Some 80% of farmers in Asia and Africa (including the landless) raise small flocks of chickens that survive by feeding themselves (scavenging) rather than by being fed.[6] Again, the importance of small-scale farm production of chickens cannot be ignored. 80% of Asian and African farmers is no small number.

The next section will identify just how important farm animals are for the daily survival of small farmers. Considering this reliance, amongst many other reasons (nutritional, environmental and inefficiency), policy and projects seeking to improve food security in developing countries must work with small scale farmers and provide advise of the detrimental effects of factory farming and suggest policy measures to address these problems.

II. The importance of farm animals for small scale farmers

The multi-purpose, non-intensive methods of raising farm animals practised by farmers in developing countries play a critical role for livelihoods, culture and social status. Animals are used for a variety of purposes to create security for farming families in developing countries. In a report commissioned by Compassion in World Farming, Janice Cox and Sari Varpama[7] identified some of these securities:

Livestock provide the rural poor with draught power, fertiliser, fuel and building material (the last three from dung), along with the opportunity to exploit common grazing areas, build collateral and savings and diversify income. In some areas of the developing world, livestock is much more. They are not only used for food (milk is a mainstay of nomadic diet, money (exchange or sale) and collateral/gift (animals are often given as a 'bride price'), but they are also a final insurance against disasters, when they are sold to buy available grain. They can also play an important cultural or social role -even revered in some cultures (such as the sacred cow of the Hindus) and playing a part in traditional festivals and worship.

While small scale farming is mostly used by family farms in developing countries, it has the potential to really get food directly into people's mouths, factory farming has just the opposite potential: to take the food out of the people's mouths. Access to the products of factory farming by poor individuals is limited because of lack of money to buy the products. These products are more likely to be exported or end up in the hands of the more wealthy members of the developing countries. If helping to alleviate hunger and poverty is the goal, then humane and sustainable farms should be pursued. Mixed farms, for example, which tend to value farm animals for all of their potential uses, give access to food, stability and economic opportunities for farmers in developing countries.

A. Draught power and transport

Motorised mechanisms for crop production are widely unavailable and unreliable in developing countries. Draught animals are used as the primary source of power and transportation of finished crops.[8] Approximately 52% of the cultivated land in developing countries- excluding China- is farmed by draught animals.[9] In Asia alone, there are 300 million animals used on all types of farms for draught powers. On mixed farms alone world wide, it is estimated that 250 million animals provide draught power and are responsible for converting 28% of the world's arable land.[2]

A wide variety of animals is used for a wide variety of draught and transport purposes to help the farmer maintain a livelihood. Examples include buffalo used in preparation of a paddy for rice in Indonesia, buffalo used for transportation of crops in China,

donkeys used for transportation of cowpea fodder in Niger, camels used for transportation in Senegal, and oxen used to plough a field in Kenya, to name a few. Farmers owning draught animals tend to have larger farms. This has suggested that owning and using draught animals, as a result of money saved on labour, increases the amount of land, physically and financially, a farmer can cultivate. Using draught animals in Nigeria, for example, has been calculated to save 221 hours/hectacre.[8]

B. Manure uses

In most countries, draught animals are used not only for power, but also for production of food from the animals (for direct consumption and for financial gain) and manure for fertilisation, fuel and building materials.

Livestock provide important by-products used for fuel and fertiliser.[10] Whereas many industrial parts of the world view manure as a pollutant and a problem, farmers in developing countries view it as a lucrative component of the agricultural process.[4] Mixed farms use animal urine and manure, which have been proven to increase the fertility of soil and crop yield.[7,11] This provides a low-cost, sustainable source of fertiliser for small farmers who do not have access to expensive chemical fertilisers. Furthermore, the residual benefits of manure may carry on for up to three growing seasons, a far more environmentally sustainable situation than chemical fertilisers. Developing countries also use animal dung for cooking fuel.[8]

C. Maximising nutrient recycling from crop residues

Crop residues, or parts of the crop that are not used for human consumption, are slow to break down into soil and it is some time before nutrients from crop residues are available to succeeding crops. However, by feeding crop residues directly to animals, residues are broken down by the microbes in the animals' stomach. The nutrients are subsequently made available in the animal waste. By feeding the animals crop residues, it is not necessary to purchase or grow additional feed.[4]

D. Income

Livestock often provide the only means of liquid assets for small farmers in developing countries. Sales of livestock provide purchasing power and access to food. Sales of livestock products equally provide unique means of income.[9] In addition to food products, fibres, skins, draught power, and manure can all be sold when not directly used by the owner.[5]

Females and children, with particularly low and uncertain opportunities for income, can find a unique possibility for stable employment through the year in livestock breeding or sales of animal products, including manure, milk, and eggs. This is especially important for the food security of widows.[10]

E. Insurance during floods, droughts and other unexpected disasters

Generally, farm animals are more likely to be sold in times of stress such as natural disaster. Ownership of livestock often provides the only means of insurance in times of need, such as drought, flood or fire. By owning livestock, the risks of crop production are substantially lowered, as there is a backup to failed yields.[9] Again, ownership of livestock is particularly helpful for the security of women, especially widows, who have limited opportunities for income generation.

F. Increasing the social status of an individual

Ownership of livestock in many societies often is related to greater social status or respect. In the Hambantota Disrict of Sri Lanka for example, families owning large herds of cattle and buffalo enjoyed a relatively high status within the village. These groups have greater access to capital assets and income.[1]

III. Replacing factory farming with humane and sustainable agriculture

With full recognition of the resource-enhancing and stabilising role that livestock play in developing countries, one must also recognise that there are still 800 million persons living with hunger and malnutrition. Examples are available where livestock ownership, even at a non-industrial level, by poor persons can prove to be detrimental to food security. In Nepal, for example, women receive loans to purchase goats as a means of livelihood, depending entirely on goat production for the repayment of loans. (Men have often left to work in Bombay.) The maximum number of goats is purchased, with the expectation that more goats mean more money. However, more goats are reared than can be maintained properly. Women, in this instance, often do not have mixed farms but rather must collect fodder daily from forests for goat feed, often leaving small children behind and resulting in adverse environmental impacts and deforestation. Herds are liable to be killed by leopards, leaving the women with no means of loan repayment.[13]

However, rapid industrialisation of crop and animal production also proves detrimental to major means of income and asset generation for those who are hungry.[2] Seventy percent of countries reporting child malnutrition also export industrially produced food. India for example has increased its food grain surplus from 10 million tons in 1999 to 42 million tons in 2000, while malnutrition remains high amongst children. India continues to look for an export market for this surplus grain.[14] Anuradha Mittal[14], a researcher for Food First, argues there is enough food to feed everyone, 4.5 lbs. of food per person per day around the world, and that the problem is one of distribution, not production.

While this argument in theory may be valid, it is unlikely that governments or businesses are going to distribute food to those who do not have the means to buy it. They are not going to give industrially produced crops or meat away for free. This has been shown to be true by the various examples of countries having surplus food produced from factory farming at the same time as having a starving population. Telwalde Berhan Egziabher[15], when discussing food insecurity in Ethiopia, stated:

In 1984 and 1985. the year of the worst famine, Northwest Ethiopia had heaps of grain, rotting, waiting for lorries to take them to areas where it was needed. Moreover, 85% of the population is still rural with no access to financial resources other than crops grown by families.

Adopting sustainable livestock use has proven to benefit the hungry more than has factory farming. The so-called food security benefits of industrial production of crops and animals have proven to bypass the poor. On the other hand, sustainable animal agriculture, when mixed with crop production in relatively self-sustaining systems, where animals are not intensively reared for global food production, has proven to provide security for poor populations. This is the system that should be embraced and developed if resolving food security is truly the goal at hand.

A. The impact of factory farming on small-scale farmers

In a 1999 discussion paper on the Livestock Revolution, the IFPRI, FAO and ILRI stated:

Small-scale backyard operations are disappearing because of low returns to labour and increased competition from large-scale producers.[2]

That is to say, the leading agencies working on hunger alleviation here admit that small rural farmers are being put out of business by factory farming. This is not new

news as UK, US and European farmers have already seen the implications of vertical integration, where meat packers (the buyers of cattle. pigs, etc.), producers of grains for feed and feedlot farms (where animals are finished) all merge under one giant company. Michael Stumo[20], the general counsellor of the Organisation for Competitive Markets, commented that 'when industry vertically integrates, it gains control of farm production. Independent farmers are no longer needed.' Very limited market opportunities are left available to small, independent farmers and ranchers and many are forced to leave the business altogether. In the United States, the implications of vertical integration and horizontal concentration, where a few firms control a high proportion of one level of the food chain, are clear. Small family farms are out and company processors are in. The top four cattle processors, IBP, Monfort (owned by ConAgra), Excel (owned by Cargill), and Farmland National, together control 80% of the beef market. The top five pig processors, Smithfield, IBP, Excel, Monfort and Farmland National (note the overlap with cattle processors) control 63% of the pig meat market.

Now this pattern is quickly taking hold in developing countries. Top agribusinesses are exporting this model of unregulated, concentrated and exclusive markets to developing countries, assisted by World Trade Organisation (WTO) regulations that prevent governments from initiating measures to protect small, independent farmers.[21]

1. Restructuring programs
It perhaps seems strange initially to consider that in developing countries government leaders are permitting these top agribusinesses to move in and displace the rural small farmer. However, several factors make it very difficult for these leaders to say 'no'. It is difficult to discuss 'development' these days without coming across the phrase 'structural adjustment'. As developing countries have found themselves in need of money, international organisations like the International Monetary Fund (IMF) or the World Bank have assisted by giving loans. But as the saying goes, 'nothing in life is free'. The IMF and World Bank in the past have lent money on the condition that they have a significant say in the economic-structuring of the country. This has resulted in developing countries chasing macroeconomic growth and, in some cases, has resulted in the reduction in funds spent on social services like education and healthcare, which clearly benefits the poor. However, developing countries'' governments are not completely blameless. National policies often favour macro-economic development and therefore encourage export-oriented livestock producers at the expense of national food security. Combined with restructuring programs, this has led to the further polarisation between rich and poor[27]

2. The World Trade Organisation
Aside from restructuring programs, there are World Trade Organisation (WTO) regulations which call for free trade. This means that a product sold within a country cannot be treated favourably by a government. Governments may not support their own product or farming industry by prohibiting external products, which may be processed at a cheaper price, from entering the consumer market. The outcome is obvious: large scale produced meat or vegetables at the consumer level are dominant and local small-scale products fall by the wayside. Small farmers have to sell their product for a price which puts them in the red and eventually the outcome, in many cases, has been to leave the farm and head for the cities in search of other employment.

3. The economy and the individual both suffer from factory farming
International organisations that affect economic development possibly do not lay enough emphasis on the crucial role that small-scale animal production plays at both

the individual and national level. Randall Baker[23] of the School of Development Studies in East Anglia criticises the World Bank for not recognising the importance that traditionally raised livestock play in 'keeping the family alive' and for commercialising livestock production and taking livestock out of the hands of the small farmer. He concludes that the success rate of World Bank development projects has been extremely low.

There are many examples that support the view that the introduction of industrial livestock rearing not only harms the rural individual farmer but also the so-called developing country. In East and Southeast Asia, for example, commercialised agriculture has been increasing with the increased use of machinery, chemical fertiliser, synthetic fibres, and financial services, such as foreign loans. As this has occurred, there has been a shift from backyard rearing of large and small ruminants to factory farmed animals such as pigs and poultry which, under the cruel circumstances of factory farms (with inhumane systems such as battery cages and sow stalls), require less time and space to maintain. Larger animals that provide draught power, such as donkeys, cows and oxen, are less and less important. As a farm mechanises, these farm animals are no longer allowed to live into their adulthood and slaughter rates increase dramatically.

As developing countries have adopted mechanised livestock rearing, they have simultaneously found themselves to be less and less self-sufficient and more and more import-dependent. Grains, tractors, oil to fuel the tractors, fertilisers and special animal units and processors are all needed for intensive livestock rearing to happen, none of which a developing country starts out by making itself. Over the last decade Asia has begun to import large amounts of grains to feed its industrially produced farm animals. Likewise, the technology, such as the machinery, the oil and the production units, is being imported and subsidised by the government. Being an import-laden economy has proven to be disastrous and unsustainable, as indicated by the Asian economic crisis of 1999, which raised prices of imported feeds and depressed urban demand.[2]

Perhaps this would all be worth it if, at the individual level, countries were finding that despite a dependent economy, individuals were becoming less poor, less hungry. Unfortunately, no such conclusion can be made. For example, in 1960, India consisted only of a small backyard egg industry and did not rear broiler chickens for meat, as predominantly used in industrialised farming. India then used a single breed of chicken to lay eggs and then slaughtered the same chicken for meat. Today, however, the poultry industry uses two types of chicken that have been bred for two functions- one breed for laying eggs and one for producing meat. By 1979, India had adopted this two-breed system. India's annual egg production had reached 12 million and she was raising separately some 24 million broilers for meat production. Despite this apparent 'development', by India's own admission, factory farming had done little to impact the ever-increasing hunger and poverty.[16] The country has become more effective at producing and exporting meat, but at the same time the number of persons without food security has increased.

Likewise, in Bangladesh, the introduction of factory farms has resulted only in an import-laden economy and has done little to improve hunger or poverty. Again, like India, this transformation dates back to the 1970s but affects today"s situation. In 1979, a firm called Phoenix Poultry Ltd. received a grant equivalent to a third of a million pounds from the Bangladeshi government to set up a factory farm for 6,000 broilers and 18,000 laying hens. Prior to this transaction, there were only 35,000 hens in the entire country, none of which were intensively raised. Despite this apparent

'sign of Bangladesh's economic recovery', the deal proved only to further deepen Bangladesh's poverty. Mark Gold[16], author of *Assault and Battery*, states:

Bangladesh had no capital to spare, extremely poor energy resources, huge surpluses of manpower and massive food shortages. Intensive poultry production only demanded capital for buildings, machinery, etc, extensive use of resources, little human labour and feeding grains to birds instead of humans and selling birds not to the hungry of the country but rather back to industrialised countries.

At the individual level, many small farmers in developing countries find it impossible to compete with industrial scale production and are forced to leave their farms in search of better income. At a July 2001 conference in London *called Local Food: The Global Solutions*, a most alarming statement was cited: 100 million in China are presently migrating out of the rural area and into the urban areas just outside of major cities.[30,31] Rural migrants, known as "peasant workers" or Min Gong, are a consequence of China's economic reforms that encouraged the diversion of rural labour into industrial production'. Major poultry and pig factories are being built to produce meat and many top international agribusinesses look at the opening up of the Chinese market with enthusiasm. Urbanisation is increasing throughout the developing world and *The Livestock to 2020* FAO, ILRI and IFPRI report noted that there has simultaneously been a significant shift in world animal production from developed to developing countries.[2]

Furthermore, at the individual level, Howarth E. Bouis and Lawrence J. Haddad[24] in their book on the Philippine Farm Household conclude that the industrialisation of food production is to blame for poor nutrition. They write:

In many less developed countries, vast amounts of land and other inputs are devoted to the production of non-staple food or inputs for manufacture, whether sent abroad or to other regions of the same country, often coexists with significant malnutrition. Might not the resources that were used to produce these exports have been used instead to produce food for the local economy to reduce, or even to eliminate, the problem of malnutrition?

Rural communities as a whole likewise do not benefit from factory farming. A demographer from the Social Science Research Unit investigated the response of a particular rural community in Swaziland to the introduction of commercial agriculture in the area in 1985. He concluded that economic stratification, where the rich become richer and poor poorer, occurred in this community after the introduction of industrialised farming. As industry moved in, poorer farmers were not able to compete with the high-tech methods of production. This move made the situation of an already struggling farmer even worse by complete incomedisplacement. Usually in this situation, poor farmers, with few city-valued skills, are forced to abandon their farms and head to the city in search of another means of income. The result is a swell in the urban unskilled (though rural skilled), and hence hungry, population. What's more is this demographer found that economic stratification happened very quickly after industrial systems moved into the area. Within five years, the difference between the poor and rich in the area had increased and become very clear within the community.[22]

Introducing industrial animal production as a means of 'developing' or improving a country's status is by no means successful. Not only is the country in debt and dependent, the people of the country are suffering even more poverty and hunger, not to mention the farm animals who are subjected to the confinement and suffering of industrial production.

4. Industrial animal production and poverty continue to grow

The 'development' of industrial animal rearing has been in the making for many developing countries since the 1970's, coinciding with ideas such as restructuring programs, as the above examples have exemplified. And one might be drawn to conclude that surely since this time, lessons have been learned and another way has been forged. Sadly, industrial animal rearing has only increased, concentrating in the hands of fewer and more global companies. And poverty, the 800 million hungry, of course, continues to grow.

Brazil's poultry industry is one example of where intensive farming has boomed at the expense of the displacement of rural farmers. Between 1970 and 1991, Brazil's poultry industry grew from small backyard farmers to a multi-national mechanised industry.[27] Through this 'development', the industry has become almost entirely vertically integrated. Originally, small family farmers were given day old chicks by major companies and were paid to raise them. For example Sadia, a family owned company, employed 14,000 small-hold farmers who raised chickens on their mixed farms, a clear benefit to the rural small farmer. The chickens were then brought back to Sadia, who processed them and distributed them to consumers. Unfortunately, this seemingly co-operative system, began to change four or five years ago. Due to financial troubles, family owned companies such as Sadia and Perdagio, where mixed farmers raised the poultry, have been taken over by financial interest groups and foreign companies. These companies are now raising, providing feed for and processing their own chickens. Perdagio is now planning to build a massive processing plant that will increase its output by 60%. Farms will now raise only chickens and/or pigs, instead of having mixed farms.[29] Certainly there are not enough places in this 'development' initiative to benefit all, if any, of the 14,000 mixed farmers whom once raised chickens for the industry.

India's dairy industry also shows a good example of where the 1970s' so-called development projects have evolved into 2000s' disasters for the rural communities. At first glance, the World Bank Operations Evaluation Department's (OED) report *India. The Dairy Revolution.*[25] reads as a success story. 'Operation Flood', as it was called, was a dairy development project funded out of milk powder sales gifted by the World Food Programme (WFP) of the United Nations and the then European Economic Community (EEC). The National Dairy Corporation and the Indian Dairy Corporation (IDC) in 1970 made a promise that Operation Flood would help farmers' lives and benefit urban consumers, not to mention set up a permanent dairy infrastructure that would solve the countries milk scarcity.[26] The World Bank OED stated that:

> *In India's dairy industry, the Bank has followed a simple, consistent, and transparent development strategy: to support the expansion of dairy production by small producers through a successful indigenous development program.*[25]

Certainly this sounds very positive. The World Bank cited benefits to rural women and children and increased consumption of milk. More children attended school, women's income increased, and 6,000 women's dairy co-operation societies had been formed.

However, before this project can be fully applauded, we must ask the fundamental question: where did all the money come from? In March of 1974, an initial US$30 million of the International Development Aid (IDA) credit was approved and two further IDA credits of US$27.7 million and US$16.4 million were approved, all to support Operation Flood. In June of 1978, a further US$150 million was credited and then another SDA 121.2 million plus a loan of US$200 million in December of 1987[25], all to this money to fund Operation Flood and its various expansions. As mentioned

earlier, this kind of money, no matter how altruistic it may seem, does come with conditions. Claude Alvares, author of *Another Revolution Fails*, wrote that:

[Operation Flood] is no poor man's organisation: it is a tightly controlled "joint stock company" masquerading as a co-operative in order to lap up any and every conceivable dole available in an environment where official policies favour the growth of co-operatives. Today, the company is one of the top thirty companies in the country- and the largest agribusiness concern. When such a group formulated a project promising to help poor farmers, and improve milk consumption among the poor, those who have experience of such matters should have struck a warning note.[26]

These are strong words, but the evidence suggests they are true. The World Bank OED wrote of shifting India from a Green Revolution to a White Revolution ('white' being milk), suggesting that the commercially intensified crop production of the Green Revolution is a kind of stepping stone for the poor, when in truth the poor have yet to see the so-called benefits of the Green Revolution. Indeed, the World Bank OED itself claims that the operation was not a 'purpose poverty removal program' as there are many different categories of 'the disenfranchised'. This was only meant to help those involved in the dairy sector. Upon reading the actual Operation Flood I & ll: Original Documents, or the contract which the Indian government signed for the above mentioned money, there is a serious lack of mention of how income will ever reach the poor.

WFP (UN World Food Programme) commodities will be transferred by the Government to the Indian Dairy Corporation which in turn will transfer them against payment to the milk processing plants in the four cities or if deemed appropriate to the feeder-balancing plants connected with and supplying milk to the milk plants in the four cities ... The funds thus generated ... will be utilised to accelerate action in the field of milk marketing and dairy development ... [26]

From this, one is left questioning how Operation Flood could directly benefit the rural poor. The dairy industry did 'develop', bringing more 'productive' breeds of cows and entirely mechanised methods of production and processing. But, as previously seen, this is not a cure for poverty. In 1991, the dairy sector was delicensed in a further attempt to attract private investment and new technology. Janice Cox and Sari Varpama write in their summary of India's livestock sector today that "larger export-oriented agri-based farmers are the ones reaping the benefits of liberalisation, whereas the reforms have failed to reach smaller farmers who continue to be marginalised".[29] They state this some 30 years after Operation Flood's promise of helping the rural poor farmer.

B. The Non-sustainability of Industrial Farm Animal Breeds

As some of the examples above have shown, the so-called Livestock Revolution requires that developing countries import and use foreign breeds of prototype farm animals. These farm animal breeds are an unnecessary strain on developing countries, as they bring with them a heap of challenges for developing countries at the expense of farm animals' welfare.

Industrial farm animal breeds cannot meet the high yields required by factory farming without high quality feedstuffs. Certain farm animal breeds through the years have been transformed as industries have worked, through selective breeding, to create breeds of high yielding, rapidly growing animals. The animals have metabolisms, which require them to eat feed that is high in energy and high in protein. Industrial farm animal breeds are sadly not able to thrive without this concentrate feed.

Breeding farm animals to this extent has put strain on food security in two ways. It produces animals that require high concentrate feed reduces farm animal genetic diversity.

1. High concentrate feed requirements
Essentially, feed for industrial breeds of farm animals must be grown, as industrially bred farm animals' nutritional needs can no longer be met by merely foraging. In some cases, farm animals would literally starve to death if they were not given modified feed to meet the animals' modified requirements for protein and energy. With the predicted increased use of industrial farm animals in developing countries, as the authors of *Livestock to 2020* have suggested, an increase in feed production must accompany this trend. So the question is - how would an increased need for special feed due to the increased presence of industrially bred animals affect the present hunger crisis?

For some time now, there have been contested arguments over the efficiency of feeding animals feed that could be feeding hungry people. The authors of *Livestock to 2020* have set out two groups: the anti-livestock and pro-livestock positions.

The 'anti-livestock' position emphasises that 'monogastric livestock account for much of the growth of production under the Livestock Revolution, [and] that these animals require high energy feed such as cereals, and that they do not fully replace the cereal calories used to produce them'.[2]

The 'pro-livestock' position emphasises that 'ruminant animals in developing countries mostly use natural grasses and other feed with little use as food. They also stress the important non-food uses of livestock'.[2]

Both the so-called pro- and anti- livestock positions have some validity. Ruminant animals in developing countries do, for the most part, at present serve multi purposes and mostly eat crop residues and natural grasses. But, as the previous sections of this paper have outlined, a shift to more industrial means of rearing livestock has been in the making for some time now in many developing countries. Part of this shift has meant a shift in the breed of animal used. The breed pro-livestock authors speak of is one where it is not necessary to import or grow additional feed to maintain the animal. Anti-livestock authors usually refer to non-grazing species, for which feed must be grown specially or imported.

The World Bank[32] estimates that some 21 % of the 1.4 billion hectares of arable land in the world is used to grow cereal to feed farm animals. Another 10% is used to grow oilseeds, roots and tubers for feed. Industrial farm animal breeds are not able to scavenge or receive crop or household residues and must consume these feed concentrates to meet their nutritional needs. The question is, would we be provided with more nutrition if we ate the feed, such as cereals, directly instead of feeding it to animals and then indirectly receiving energy or protein by eating the animals' meat, milk and eggs? The graph below exemplifies the disagreement among experts on the efficiency of conversion of energy and protein by animals.

A. Input of edible human food/output used in in human edible food California example. (de Haan, 1998)[32]

In % efficiency

	Energy	Protein
Milk	101	182
Beef	85	120
Pork	58	86
Poultry	31	75

B. Efficiency with which feed is by animal population. (Spedding, 1996)[33]

In % efficiency

	Energy	Protein
Milk	12-16	40
Beef (suckler)	3.2	9
Pork	23-27	17-22
Hens'eggs	11-12	24

Table A emphasises that animals, are very efficient at converting feed into energy and protein to humans. This table, considers only edible human food into the efficiency equation. Where efficiency is at or over 100%, an animal, such as a sheep, has converted something which humans cannot derive energy from, such as grass, into something humans can derive energy from, such as meat. Table B on the other hand emphasises just the opposite: that animals are incredibly inefficient converters.

While Table A's analysis may initially seem fair, as Professor Spedding of the University of Reading points out, there are a considerable number of factors which may effect so-called efficiency which make a simple conversion very difficult. Not only do different species, not to mention different breeds of each species, display different abilities to convert different kinds of feed, but they do so differently in different climates and environments. Furthermore, some land cannot support animals, and hence raising crops would be more 'efficient'. Equally, some land cannot support crops, and hence raising animals would be more 'efficient.' There is also the issue of how much energy is needed for, or lost to, replacement breeding, which are animals that are not usually eaten by humans for their meat and would not be considered in Table A's analysis.

Additionally, Table A does not consider the excessive *resources* - the land, the water, the labour, the money, the time- that are put into raising feed crops, regardless of whether or not humans can eat them. Animals raised in an industrial way must be fed concentrate feed, which must be grown specifically for the purpose of feeding animals. While the issue of efficient protein and energy conversion may be exceedingly difficult to resolve, it is more clear to understand that producing food from industrial farm animals is two steps. First we must grow their food and then we must raise the animals. Spedding writes that despite the controversy,

... crop production is generally more efficient than animal production in the output of dietary protein and energy on land that will grow crops. This is so for the use of land area, incident solar radiation, water, fertiliser and support energy.

Spedding goes on to mention that animal production includes losses in disease, pests, and parasites plus often enormous losses in storage, processing, transport, preparation and cooking. This is not to say that raising crops doesn't suffer these losses. However, producing food from industrial farm animals takes one extra step and therefore is less efficient in terms of limited resources. First we must grow their food and then we must raise the animals.

Even the World Bank[31] admits:

Livestock are often blamed as inefficient users of feed and energy. And indeed, in some systems, and especially in some phases of the production (e.g. the last phase in a beef feedlot), energy and nitrogen conversion is poor.

Conclusively, because industrial breeds of farm animals require concentrate feed, which must be grown separately, eating meat for energy from industrially raised farm animals is a far less efficient means of acquiring energy than eating crops directly. And for a world of 800 million hungry, this efficiency is crucial.

2. Low genetic diversity

Cees de Haan writes in a World Bank report[32] that' past attempts at improving livestock productivity in developing countries have focused largely on importation of exotic breeds.' This report goes on to discuss that' over the long term most exotic breeds have not been able to maintain high levels of productivity. The result is not only a loss in biodiversity but also a loss in economic returns.' The FAO[38] states that at present 30 percent of all livestock breeds are at risk of extinction. The FAO writes:

Loss of animal genetic resources has been the greatest in developed countries, which have often concentrated on a few high-input breeds to the detriment of their locally adapted breeds. In developing countries, rapid transformation of traditional agricultural system, often through the indiscriminate use of exotic animal genetic resources, is the primary force that is contributing to the loss of livestock breeds.

One of greatest misjudgements of the so-called Livestock Revolution is lack of emphasis on the strong role that genetic diversity plays in food security. For some 12,000 years domestication and breeding under different environments have resulted in some 4,000 breeds of farm animals. The genetic diversity of these breeds has made it possible for humans to thrive at all corners of the globe, in wide ranges of environmental challenges including varied climates, diseases, parasites and pests.[38]

Local farm animals in particular environments have developed resistance or adaptations to a full range of these environmental challenges. Exotic industrial breeds often encounter major difficulties adapting. In Kenya, development agencies have been trying to change the Masai's traditional ways, offering more 'productive' breeds of cattle only to be met with disaster. As *The Economist*[35] reported, 'When the drought [begins] to bite, the pedigree Friesians [are] the first to drop...' Industrial breeds of dairy cows such as Friesians and Holsteins require ample water and are not suited for the rough Kenyan environment. Furthermore, as the drought ends and the rains begin to fall, those which have managed to survive, cannot then stand-up to the chilly showers.[38]

But before even being introduced to these environmental challenges, most industrial breeds of farm animals are often badly adapted to temperature and diseases in general. This is exemplified, for example, by the increased incidence of mastitis in the Holsteins and Friesians bred solely for dairy production. A Czech study in 1985 showed the incidence of mastitis of a local, acclimatised Bohemian Pied breed of dairy cow was far less than the incidence in a solely dairy Hoistein breed.[34]

Furthermore, the industrial breeding of farm animals has pushed animals to be so alike that their lack of genetic diversity leaves little flexibility for the breed to flourish in the face of unpredictable diseases or climate changes. At present, the Holstein breed dominates dairy production, accounting for 60% of Europe's and 90% of the USA's dairy production. It is projected that by 2015, the U.S. Holstein will have an effective

population size of 66 animals. That is to say that only 66 animals will not be related.[32] This presents a major issue for health and welfare of the breed as it would be exceedingly easy for one health problem to severely effect the entire Holstein population in the US.

The example of dairy cows has been used to exhibit that industrial breed of farm animals are not well adapted. By no means is this isolated to dairy cows. Industrial breeds of farm animals also suffer: pigs are susceptible to sunburn, heavy-breasted broiler chickens have increased incidence of heart failure and painful lameness[36] ,and double-muscled beef cattle have calving difficulties[37],to name a few.

Not only does industrial farm animal rearing promote poorly adapted breeds, but these breeds are extremely fragile, unable to face environmental challenges due to low biodiversity amongst the breeds. And as Cees de Haan has already pointed out, poor adaptation translates to low productivity and economic loss. Developing countries, already facing dilemmas of hunger and poverty, cannot afford to use such needy sources of food, which require special feed and which are often poor survivors.

C. Putting things right: humane and sustainable animal agriculture in developing countries

As the examples above have clearly exemplified, the Livestock Revolution, like the Green Revolution, is not intended to help alleviate poverty. It is a business, an industry project to increase profits, a chance for the livestock industry to dip its hands into the natural resources of developing countries. The problem is that the product being held at ransom is something that, when not accessible, causes starvation: food. The high-tech Green Revolution doubled global food production in little more than a generation, but poverty and hunger continue. Labour has been replaced with capital. The Green Revolution, like the Livestock Revolution, is designed for using capital to buy the technology necessary for high-yielding, rapid production. This is not a reality for 'working the poorer land, or helping the illiterate farmers with plenty of labour and ingenuity but little capital'.[17]

A study conducted by SAFE - World (The Potential of Sustainable Agriculture to Feed the World), on sustainable agriculture found that one of the key factors which led to successful sustainable agriculture in developing countries was 'a social learning and participatory approach between projects and farmers".[18] These successes were marked by increased food production for the actual farmers and sound environmental practices. Sustainability emphasises adaptability to local technologies and practices, rather than imported technologies as the Green Revolution and Livestock Revolution would endorse. The study states that 'agricultural systems with high social and human capital are able to innovate in the face of uncertainty'.[18]

In the Punjab Province of Pakistan, according to a three-year study by researcher Takashi Kurosaki[10], published in 1995, traditional farms in the Indus basin generally prospered from sustainable livestock use. Farms consisted of a mix of bullocks for draught and several buffaloes for milk production. Bullocks provided draughtpower for crop cultivation and she-buffaloes and cows produced milk, which was directly consumed or used to make ghees, lassi, or paneer. These products were also sold to markets, providing additional income. Crop by-products were fed to the animals and livestock manure and urine provided fuel and fertiliser. Families, including the women and children, found stable self-employment throughout the year. Livestock were also valued as a liquid asset and insurance in case of a bad year.

In sub-Saharan Africa, a 2001 *World Poultry* study indicated the importance of sustainable family poultry rearing. Where one or two breeds of broiler chicken are predominantly used in factory farm systems and generally must be imported, 85% of rural families keep one or more species of poultry of indigenous or local types. These local breeds are preferred over foreign breeds by local consumers. Furthermore, these breeds are better adapted to local diseases, pests and climate than are foreign industrial breeds (This argument of using local over industrial breeds of farm animals also applies to beef cattle, dairy cows and pigs). Poultry are raised by extensive, semi-extensive and small-scale intensive husbandry systems, although extensive systems dominate. With extensive production systems, birds are reared with little land, labour or capital and can be accessed by even the poorest social communities in rural areas. This sustainable poultry sector has proven important to food security, poverty alleviation and environmental health. The sale of poultry products provides direct income for rural African families. While men and boys in a family generally sell the birds, women tend to raise them. Poultry raising has contributed to the 'greater empowerment of women by improving their financial status, if socio-cultural and religious environments allow it'.[19] A *World Poultry*[19] study indicated that an average flock of 5 chickens enabled a woman in Central Tanzania to earn an additional US$38 per year or 9.5% increase in income.

With humane and sustainable animal farming, there is great potential for not only improving poorer people's access to food, but also at improving their independence and living situation. This potential should be harnessed to its full capacity by policy makers and development projects. Factory farming does not have this kind of positive potential.

IV. Conclusion

Factory farming of animals is continuing to become ever more present in developing countries. The so-called Livestock Revolution has already begun to take hold. Backyard and small-scale livestock rearing is being replaced by industrial livestock production. Factory farming, while it undeniably increases the actual amount of food produced, is not a method by which those who are hungry can gain better access to food. Not only does the factory farming of animals harm individuals by displacing them from their livelihoods, but countries as a whole suffer. They become import dependent and less free to make decisions that could improve hunger and poverty.

Furthermore, the breeds which industrial factory farming requires puts an unnecessary burden on developing countries. These breeds require high concentrate feed which must be grown separately. They also are low in genetic diversity, cannot survive in the midst of environmental challenges and are not well adapted in general.

The key to alleviating food insecurity in developing countries lies in humane and sustainable practices of farm animal rearing, as farm animals can play a crucial role in access to additional income and security. Successful sustainable farm animal agriculture in developing countries results when 'a social learning and participatory approach between projects and farmers" and local technologies and practices are adopted. International development organisations recognise the crucial role that animals, when raised for all of their potentials in an extensive way, play in stabilising individual families in developing countries. The so-called Livestock Revolution must be curtailed before the current crisis of 800 million hungry further intensifies. Getting more individuals in developing countries involved with humane and sustainable farm animal rearing has great potential for alleviating hunger, while factory farming will almost certainly further the current hunger crisis. Above all, there is an ever pressing need for policy to prevent agribusiness from reaping private profits at the expense of developing countries' environment, genetic diversity, and poverty alleviation.

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Marketing rare breeds in sub-Saharan Africa

by Keith Ramsay[1]

1. Introduction

The long-term future of any breed of farm animal depends largely on its commercial value – and/or its ability to meet specific needs through sometimes, unique traits. This applies particularly to many indigenous breeds that are often perceived as having no real commercial value.

In recent years, at a global scale, animal agriculture has seen a dramatic decrease in numbers in many of these breeds - mainly because they were unable to 'compete' with international breeds and composites. Rare and endangered breeds are often conserved by enthusiasts and conservationists - some of whom are aware of the importance of maintaining as much biological diversity as possible and the fact that many of these breeds have unique traits that either are/or could become important in modern animal production systems. Lasting conservation of Farm Animal Genetic Resources (FAnGR) will however depend, to a large extent, on the sustained use of local breeds by their traditional owners. This, in turn, will depend on the commercial value of the breeds concerned. It is therefore important to capitalize on any traits that will make a breed an economically attractive and, thereby, viable alternative to more popular breeds.

Sub-Saharan Africa has a number of lesser-known and endangered breeds that fit into the above categories. Relatively small carcass size, non-uniform colour patterns and a general lack of information on production potential have made traditional owners change to often less-adapted exotics. Such changes are often support by, or on, the initiative of leaders and developers who have similar perceptions of the value of local breeds. The paradigm of 'bigger is better' will, however, only change to 'locally adapted may be cheaper and more efficient' if user-friendly information can be linked to incentives farmers and traditional owners such as access to viable and long-term markets for the breeds concerned.

In discussing possible incentives to promote the marketing of lesser-known and rare breeds, a model of community-based breeding and marketing is suggested. Within this model, ideas to operationalize the support to marketing from servi-centers in communally grazed areas and marketing breeds through an annual show and sale or by 'catalogue' are presented. The opportunities to use the adding value concepts for traditional animal breeds are highlighted.

2. Community-based breeding and marketing schemes

Communities that have indigenous breeds or that show an interest in farming with endangered breeds can be assisted to establish breeding and marketing schemes where individually or group-owned animals are marketed. This can be either at an annual production sale or through local sales or even through an export channel.

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Figure 1 shows the basic concept of a community-based breeding and marketing scheme.

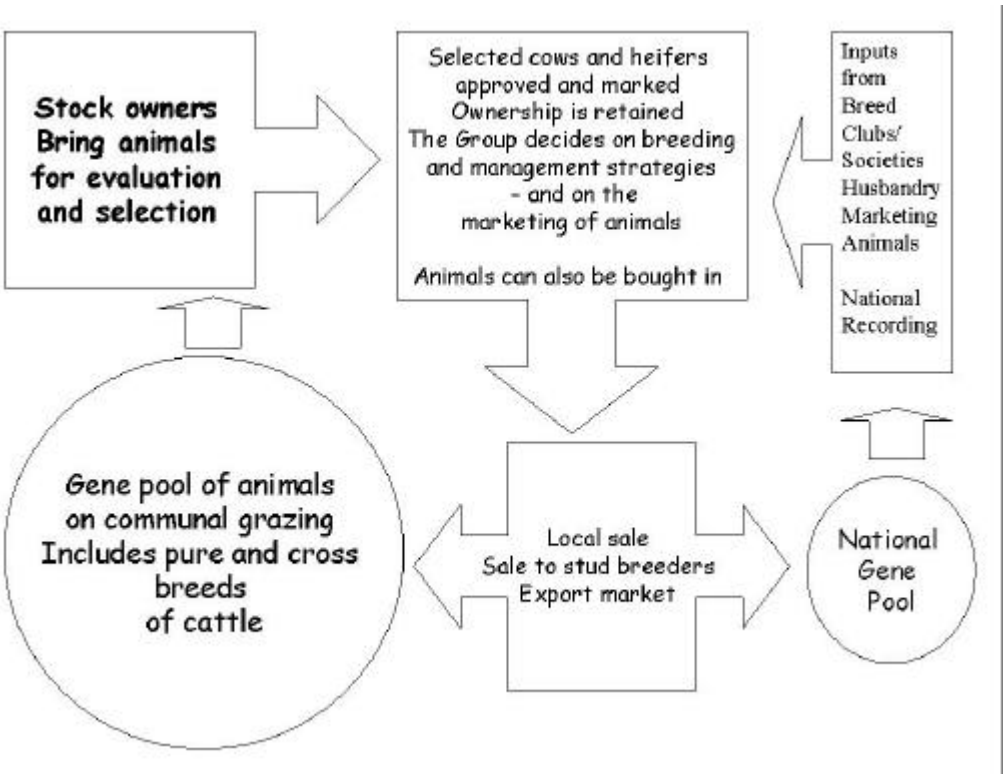

Figure 1. The basic framework of a community-based scheme.

Community schemes can be enhanced by establishing 'one-stop' service centres to provide inputs such as central collection facilities, single-channel marketing and information and advice on critical husbandry issues. Such centres also have the capacity to provide assistance to a broader spectrum of stock owners in the community.

3. Strategically placed service centres in communally grazed areas

Very often, stockowners in the traditional areas are unaware of the fact that markets do exist for their specific breeds. Access to these markets is often limited by problems such as transport, communication and facilities to inspect and process the animals (health clearance, identification etc.). This often leads to exploitation by breeders and traders in the commercial sector. By establishing a marketing facility at a strategically placed service centre, stockowners would not only be able to sell animals on a more regular basis – but also would have easier access to information, training and basic stock remedies.

A basic holding facility could be constructed to serve for the inspection and clearance of animals to be sold – and as a mating and calving camp (Figure 2). Basic facilities for artificial insemination (AI) could also be included – if there is a need and if the management of the animals in question is at a level to justify such a step. In addition, the service centre could act as a store for hides and skins – and could also be used to process skins (in particular) as this can be done on a small scale. The processed

skins could then be used to make items for local cottage industries. Such centres need not be elaborate. Dip tanks and extension officer complexes could be easily adapted for this purpose.

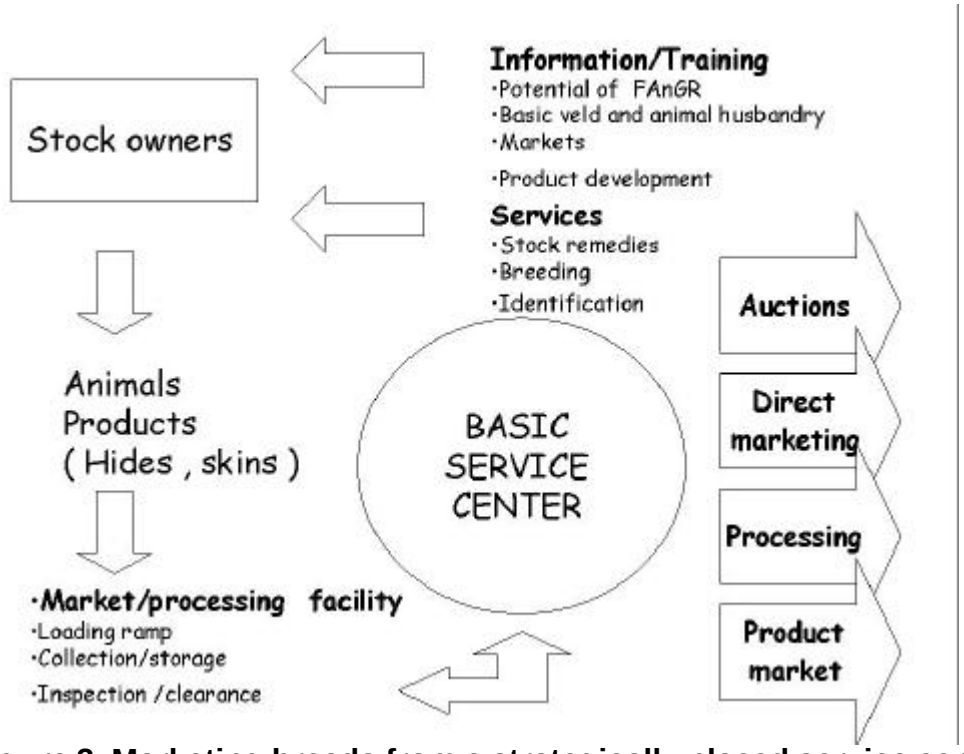

Figure 2. Marketing breeds from a strategically placed service centre.

4. Show-and-sale concept for use in sub-Saharan Africa

The NGO Rare Breeds Survival Trust (RBST) is an established breed-conservation oriented organization in the United Kingdom. Part of RBST's annual activities includes a show and sale of rare UK breeds. This activity takes place over a few days on the Royal Show Grounds near Leamington. All the animals shown are for sale, and all the respective breeders' clubs or societies are represented. The show-and-sale also includes a wide range of value-added products such as wool, mohair, clothing, leather goods, meat and milk products. A wide range of related items such as stock handling equipment, stock remedies, processing equipment, reference books, artwork etc. is also sold. This has become a major event in the UK and is well supported by the general public, breeders and enthusiasts. A number of breed societies also hold their annual general meetings during this event.

The South African breed conservation NGO, the Farm Animal Trust (FACT) reviewed and adapted the RBST model. The first South African show-and-sale of local and lesser-known breeds was held during 1999. The show-and-sale aimed to influence public awareness, to further the distribution of genetic material, and to broaden the emerging farmer sector's access to markets for their indigenous breeds. It is hoped that this will become an annual event. The possibility of two sales – one to serve the predominantly cattle-orientated North and one to serve the mixed small-stock cattle areas in the South of the country is currently being investigated. Figure 3 illustrates the basic concept of a show and sale.

The testing and development of this model need not be elaborate. Where possible, an existing infrastructure (such as a local showground, service centre) or saleyard should be used to test the concept. f successful, alternative and more convenient venues can be used.

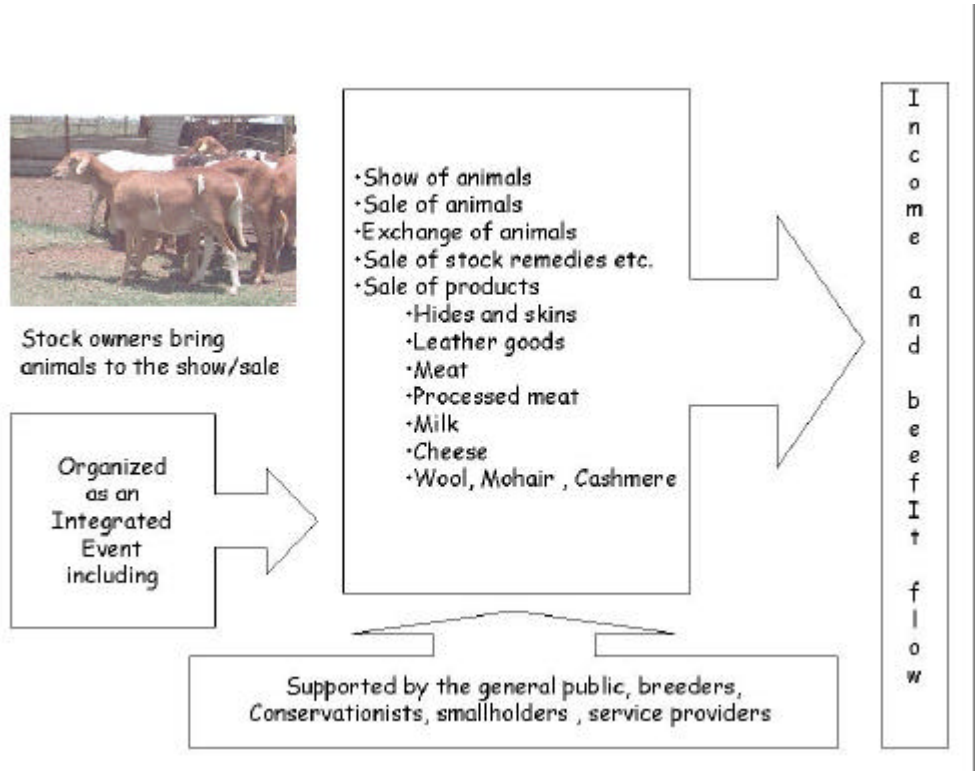

Figure 3. A basic framework for a show and sale of local breeds.

5. Marketing breeds by 'catalogue'

During 1999, FACT published a book on South Africa's indigenous and locally developed breeds as part of an initiative to conserve breeds through commercial use. Information on production environments was included to help match animals with farming system conditions. It also serves as a useful reference on 'value-added' traits that are often overlooked. This could give the breeds in question a competitive edge.

The book has been distributed locally, regionally and globally, and is being used as a reference in some schools, colleges and universities. It has enabled prospective breeders and producers to contact suppliers of genetic material and services – either through the respective breed societies and clubs or through individuals advertising in the book. It is hoped that traditional owners of some of the breeds will also become involved in the supply of breeding material as well as in the direct exchange of genetic material with established commercial breeders such that the lion-share of the added value is not 'consumed' by middle men.

6. Adding value to increase breeder and consumer demand

A lasting market for a specific breed is largely dependent on both breeder/producer demand for animals – and consumer demand for products such as meat, milk, fibre and leather.

Breeder- and producer-demand considers traits such as fertility, adaptability, ease of birthing, tolerance to parasites and some diseases, and the ability to produce

consumer-demanded products as efficiently as possible. Linking all this information on the animal breeds together in a user-friendly form and developing markets for unique products such as 'grass-fed beef/mutton', residue-free milk, quality fibre and leather is all part of a value-adding process. In discussing value-adding to increase breeder and consumer demand, local breeds of cattle, sheep, goats and pigs offer ample opportunities. Some examples are presented below.

Table 1. Economically important traits: adding value to Nguni cattle

Trait	Links	Added value
Adaptability	Direct link with fertility, feed utilization	Minimum care breed
Fertility	Cow productivity; production per unit area	Cost effective production
Cow productivity	Milk production; Adaptability	Link to minimum cost farming
Temperament	Cow productivity, fertility	Link to fertility, meat quality
Ease of calving	Skeletal structure – sloping rump	Link to cow productivity and industrial crossing Custom-bred feeders
Parasite tolerance	Adaptability, Fertility, Cow productivity, hide quality, grooming behaviour	Cost effective production; better quality hides; meat marketing (no dips)
Disease tolerance	Adaptability	Cost effective production; meat marketing (no stock remedies)
Meat quality	Early maturing type; Crossbreeding potential	Top quality beef – potential for branded beef market Link to Custom breeding for feedlots
Colour patterns	Short hair covering; Symmetric patterns	Market hides and products – hair on hides sell for R2000 up.
Hide quality	Parasite tolerance	Unblemished thin hides – ideal for upholstery

6.1 Nguni cattle

For many years, Nguni cattle were perceived to be inferior to other cattle breeds – largely because of their often-smaller size and varied colour patterns. This situation has changed. Research into the potential of the breed and the establishment of a breed society has helped to bring about this change. Information on the unique characteristics and added advantages of the breed is now more readily available.

On-going development of markets for products such as hides and branded beef will ensure that the Nguni is in demand as a commercial breed – and not just as a breed to be sold and marketed between stud breeders.

6.2 Indigenous sheep

South-African indigenous sheep breeds include fat-tailed (Pedi, Damara, Zulu, Afrikaner) and fat-rumped varieties (Persian). In comparison to some of the locally developed composites such as the Dorper (Dorset horn–Persian) and the Afrino (Afrikaner–Merino), these breeds have a smaller carcass and have also been downgraded in the past as a result of the fat tail – or fat rump.

Although not always seen as a value-added advantage, indigenous breeds are often used to develop hardy composites. This often helps conserve a pure nucleus.

The average market carcass weights of some of the pure and composite sheep breeds in South Africa is illustrated in Table 2. Farming with pure indigenous sheep breeds can be made more profitable by considering some of their characteristic traits from an economical perspective: see Table 3.

Table 2. Average market carcass weights of some South African indigenous and composite landrace sheep breeds (source: Snyman, 1998)

Breed	Carcass weight
Mutton Merino	22
Namaqua Afrikaner	18
Afrino (Merino x Afrikaner)	20
Persian (Somali)	13
Dorper (Dorset x Persian)	18

Table 3. Adding value to indigenous sheep – economically useful characteristics

Characteristic	Added value
Quality skin	In demand for fashion items and garments
Parasite tolerance	Less damage to skin – lower maintenance costs – stock remedies
Fat tail	Sold as a delicacy– or as an ingredient for locally made meat products (fresh and dried sausage)
Residue-free meat; quality meat	Capitalize on the market for healthy meat as well as a branded (local sheep) mutton.

6.3 Adding value to indigenous goats

The South African Improved Boer goat is an example of what can be achieved by improving an indigenous breed for a specific purpose. The Boer goat is in demand in a number of Countries for use as a meat-producing goat and genetic material has been exported to Canada, USA, Australia and New Zealand.
Unimproved goats, of which there are a wide variety, are generally regarded as having little to no economic value – and some ecotypes could become endangered

fairly shortly as a result of this perception. Value can be added to these goats by capitalizing on one or more of the following:

Characteristic	Value
Resistance to heartwater (Cowdria)	Lower mortalities; minimal use of stock remedies
Tick tolerance	Less damage to skin; minimal use of stock remedies
Quality skin	In demand for fashion items and garments
Capacity for crossbreeding – milk	Potential to develop hardy composite milk producers
Capacity for crossbreeding – cashmere	Quality cashmere as an added product
Capacity for crossbreeding – meat	Can be used to breed a more hardy meat producer in areas where pure Boer goats are unable to survive without additional management and remedy inputs

Cashmere could become a useful value-added product and initial trials have shown that South African indigenous goats produce good quality cashmere. Selection for higher production could lead to the development of a multi-purpose goat – meat, milk and cashmere.

6.4 Indigenous pigs

South Africa has two basic indigenous pig breeds: a short-snouted 'Kolbroek' and a longer snouted 'Windsnyer'. Both are often seen as less efficient than the more modern pig breeds and their tendency to put on excess fat is also considered a disadvantage. Despite these perceptions, these breeds are capable of generating a good income and are, in fact, viable alternatives to more modern breeds under less intensive production conditions.

Table 4. Adding value to indigenous pigs: economically useful characteristics

Characteristic	Value
Conversion of coarse fibre rations and root crops	Suitable for free range systems; less dependence on expensive high grain rations
Parasite tolerance	Less expense on stock remedies
Strong feet	Can be used to improve the feet of modern breeds with foot problems
Excess fat	Fat can be trimmed off the carcass and reduced for sale as lard and crackling
Meat	Niche market potential – tasty and additive free pork

7. Concluding remarks

A large portion of the lesser-known and rare breeds of farm animals in Sub-Saharan Africa are owned by the traditional/family sector where information on, and access to, markets for these animals is often limited.

These resources are, however, of critical importance: to the well being of the owners and to the maintenance of diversity in both local and regional FAnGR.

Developing and improving market opportunities for these breeds and for value-added products such as hides and skins, branded meat, milk, fibre and processed goods will encourage stock owners to continue farming with the animals in question, and enable those considering a change to often less suitable breeds from the global gene pool, to re-think their decision.

Combining the value-adding process with the development of one or more of the models discussed could result in a much-needed paradigm shift towards the hardy adapted breeds of the region – and towards lasting conservation through sustainable use.

Government departments and NGOs involved in the development and enablement of rural communities and stock owners should consider taking the initiative to plan and implement such models – with the full cooperation of the people in question.

Such models may also be attractive to international development agencies as they will facilitate, and be largely dependent upon, optimal people participation.

Acknowledgement

The author thanks Ms Siboniso Moyo for presenting the paper at the Workshop in Lusaka, 11–14 September 2001.

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Conserving the Aseel poultry[2]

by Sagari R Ramdas[3]

The Aseel is an indigenous Indian chicken breed. It has been selectively bred and reared by the local Adivasi communities in the East Godavari district for centuries. Today the Aseel – like many other indigenous breeds of India – is threatened. This article describes the innovative strategies used by four local organisations (see below) to preserve and promote this breed.

The Aseel was probably selectively reared, by the local adivasi communities (indigenous people), from the original Red Jungle Fowl, which has been recognised as the ancestor of many of todays modern domestic poultry breeds. The Aseel breed is reared and managed entirely under backyard poultry management practices and provides a vital source of income to the average adivasi household. Women are completely responsible for the chickens, which includes day-to-day feeding and management, health care, sales and purchases. It is the breed of choice in the region as the meat is very tasty and highly relished, animals command a good price in the market and the males can be used in cock fighting.

Traditionally, bred for their meat and strength, they are not prolific layers, with the average number of eggs laid ranging between 36-60 a year. Eggs laid during the summer (in May) may be eaten as the excessive heat results in them spoiling, but generally the average Adivasi farmer allows nearly all the eggs laid to hatch. Of the live birds that hatch and survive between 60-70% are sold, 15-20% are consumed at home and the remaining 10-15% kept as breeding stock to increase the flock.

In the local market, the Aseel birds are sold at an average rate of Rs.100/- per kg. During the festival Shankranti in the month of January, fighting cocks are priced from Rs.500/- to Rs.1500/-. The cocks with the preferred plumage are more valuable and command a higher price.

In 1996 several organisations investigating the Aseel breed looked at the local production systems. On an average each household owned between 5-10 adult hens, although some had up to 50 animals. While a farmer could potentially earn Rs.4,000/- per adult hen per year (after adjusting for acceptable losses), in reality farmers were earning less than half of this due to production losses resulting from egg spoilage/infertile eggs (63%) and chick mortality (37%) which was largely due to predators, fowl pox and salmonellosis. The average annual mortality amongst the village poultry population ranged between 70-80% and was primarily due to diseases such as Ranikhet (New Castle disease) and Salmonellosis/White bacterial diarrhoea. In a livelihood scenario where every adivasi family is steeped in debt these losses are critical. Preventing the loss was clearly a major way to prevent increased indebtedness.

Another major concern was that the high annual mortality was threatening the Aseel gene pools. Farmers were concerned that it was getting increasingly difficult to purchase pure Aseel birds each year to replace their stock. Each year the community reported a decline in the Aseel poultry population. Simultaneously, local government bodies, convinced that the only way to 'alleviate poverty' is through programmes that

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[2] Originally published in: *Ecology and Farming* 27:12-14, May 2001. Reproduced with kind permission of IFOAM Ecology and Farming. Oekozentrum Imsbach 66636 Tholey-Theley, Germany. Web: www.ifoam.org

[3] This article is the result of collective work of many individuals from four organisations, namely Yakshi, Anthra, Girijana Deepika, and Womens Gottis of East Godavari Adivasi Areas.

they conceive to be profitable, promoted non-local breeds such as 'Giriraja' that have a high egg producing capacity. However, the 'production' goals of such breeds are completely incompatible with local livelihoods, markets and cultural practices – the production and breeding goals of the backyard poultry keeping practised by the local Adivasi communities is for the value of meat and for cock fighting, not for the sale of eggs.

To prevent further losses and to increase the Aseel population, while simultaneously dissuading the local government from actions that threaten the breed's gene-pool, the women of the wider community implemented a two pronged action plan:

Reduction of mortality amongst the Aseel village population through improved management practices.

Improved feeding

Government incentives and subsidies had encouraged the Adivasi farmers to grow tobacco and cotton in place of traditional food crops. While the first few years were profitable, unstable international markets meant farmers could not sell their crops in subsequent years and many went into debt. In addition, the shift to cash crops severely threatened the food, fodder and feed security of the community. The Aseel poultry also suffered as the traditional feeding was linked to the grain/by-products of the traditional millets. With the change in crops, women had to purchase broken rice/paddy husk, and hence fed the birds minimally.

Realising the far-reaching implications of changing cropping practices, a vigorous campaign has been carried out to emphasise the importance of growing local food crops, and today many farmers have realised the necessity and gone back to growing the traditional crops.

Training village Animal Health Workers

Selected women and men were trained as animal health workers (AHW), and a special component of their training was on poultry. They were equipped with preventive and curative practices that combined local knowledge systems of poultry care, which are fast disappearing, with simple homeopathic and essential allopathic practices, such as vaccinations.

The village animal health workers are at hand to carry out preventive measures such as mass vaccination and monthly de-worming and also to provide curative services, when required. An additional responsibility of the AHW is to disseminate information to the women.

Skills building for Women

Simultaneously women from Gotti (see box on left) participated in workshops where they shared management practices and learnt new practices from the AHWs and the Anthra team. Measures to build immunity and reduce susceptibility to contagious diseases, and recognition of the importance of deworming, alternately using homeopathic and herbal remedies, were developed.

Through these efforts the overall morbidity and mortality has declined drastically. Additionally there has been significant reduction in egg spoilage and loss due to predators. Naturally, not everyone adopted and implemented all the practices and hence some loss still exists. A re-survey of the same 24 villages a year after intervention revealed that overall mortality had reduced from 70% to 17%. The following year (1998-99) the mortality was down to 6% with a two-fold increase in the Aseel poultry population.

Development of the village Aseel poultry through improving and expanding the populations.

In December 1999, a traditional system of sharing and asset building, called 'vaata', was initiated, to improve the Aseel population. In this project women were given a couple of Aseel hens and each village some breeding cocks. Each recipient was mandated to return half the subsequent chicks produced by the hens. The returned chicks were redistributed or sold and the savings contributed to the collective savings.

At the start, 200 hens and 67 cocks were distributed to 196 women in 20 villages. At the end of the following year there were 1,414 offspring (after correction for egg spoilage and mortality), with 194 eggs yet to hatch. An additional 54 women joined the vaata system during the course of the year. Benefits of the scheme include:

At the household level

With more poultry the women are able to sell birds and get money when they need to have cash, thus the dependence on moneylenders has been reduced. It also has resulted in an increase in consumption of poultry at the household level.

At the village level

More women are able to get good quality Aseel breeding birds. This in the long run will lead to an overall increase in the Aseel gene pool.

At the programme level

An initial investment of Rs.60,000/- was made to purchase birds for the scheme, and to provide a small medical kit to each village. This was completely recovered by the end of the first year. With such a good initial success more villages have been brought into the scheme.

The women have started a village revolving fund for medicines and vaccinations at the Gotti. Each member contributes Rs.3-5 per month towards this. Necessary medicines as well as vaccinations are purchased from this.

There are still several issues that need to be addressed before the village birds can be used to their full advantage. For instance, fowl pox continues cause of a high chick mortality. The problem is directly linked to the practical application of the commercial preventive vaccine in the rural Adivasi village context. Chicks, a few of which hatch each day in the villages, need to be given F1 RD drops, and then a booster RD vaccination two months later. The vaccine, though, is produced for large commercial situations. It comes in large quantities (1000 doses) which, when opened will not store for long, especially as is common in the villages, if there is no refrigeration. This results in high wastage of vaccine doses. In addition, the vaccines have to be purchased from the closest town, located two hours away by road, so it is not a simple matter of picking up the vaccine when it is needed. With all these obstacles, despite all the best intentions, many birds are often not vaccinated as per the required schedule.

A better marketing system is also essential if the adivasi household are to accrue the benefits of a sale, rather than a middle-man. A system of collective cooperative marketing would ensure this and steps are being taken to initiate this.

Finally, the government must be persuaded to change its policies for adivasi areas. The documentation in support of the important role of the Aseel birds and economic benefits to the adivasis is being used to lobby policy makers.

It is essential that the introduction of hybrid poultry, which endanger the Aseel gene-pools through interbreeding and threatens the livelihood of the local communities, is stopped.

In Conclusion

While still in its early stages, the efforts of the project have resulted in strengthening the people's livelihoods, enhancing economic returns as well as being an important step to conserving and promoting the Aseel breed. Women are able to sell birds and earn money – which helps the family in a context of acute indebtedness. Being an entirely women-run enterprise, the intervention has resulted in women acquiring new skills, capacities and playing important decision-making and leadership roles.

Experience tells us that local breeds cannot be conserved *in-situ* without recognising and respecting the close relationship that exists between local breeds and livelihoods. Livestock policy makers must move beyond their current narrow frameworks of thinking, which assumes the only solution is to increase economic gains of the farmer through the promotion of the exotic high yielding crossbreeds, and completely ignores the important livelihood and economic role of the local breeds. Through this policy they are closing all doors for the local breeds. Reversing this trend requires concerted and focussed intervention, both at micro and macro policy levels.

Intellectual property rights regime necessary for traditional livestock raisers[1]

by Ilse Köhler-Rollefson

This article discusses the need to recognize the intellectual property rights (IPRs) of pastoralists and other traditional domestic animal raisers in the light of the growing interest in making use of the genetic traits of indigenous livestock breeds.

According to the Food and Agriculture Organization of the United Nations (FAO), which has the global mandate for the conservation of domestic animal diversity, about one-third of the 5000 officially documented livestock breeds are threatened with extinction and are dying out at the rate of almost two per week. At the same time, the value of local breeds and their advantages over high-performance breeds are becoming increasingly evident (FAO 1999).

For decades, local or indigenous livestock breeds were regarded as inferior to the high-performance breeds developed in the North. Cross-breeding with exotic animals has led to the dilution of indigenous breeds, and this is one of several factors responsible for a very severe narrowing of the genetic base of our domesticated animals. But now more and more reports are indicating that the performance of indigenous breeds is equal to or even better than that of improved or cross-bred animals. In India, for instance, the enormous rise in the country's milk output is due to indigenous buffaloes, rather than cross-bred cattle (Rangnekar 2000). In Ethiopia, a detailed study comparing the outputs of improved goats (Anglo-Nubian x Somali) with those of local breeds revealed that improved goats, while they grew faster, were much more susceptible to weight loss during the dry season, thus offsetting the previous gains (Kebede 2000). Although they gave more milk per animal, this was not the case when the yield was calculated in relationship to body weight.

Disease resistance of indigenous breeds

One of the crucial traits of indigenous breeds has to do with their ability to cope with diseases. For instance, the Red Maasai goat has proven very resistant to infestation with internal parasites (ILRI 1998). The Uda sheep of Northern Nigeria is much less susceptible to foot rot, while the Kuri cattle kept along the shores of Lake Tchad are very resistant to insect bites (Blench 1999). N'dama and other humpless African cattle are trypano-tolerant or resistant against infection with trypanosomes, tiny one-celled parasites that live in the blood. Such disease resistance is compromised when animals are selected only for high productivity. For example, the Orma Boran cattle kept by the Orma people in the Tana River District of Kenya are much more resistant to trypanosomes than their relative, the Improved Kenya Boran, which has been selected for meat gains over several generations. Thus in areas where tsetse pressure is high, the Orma Boran gains weight faster than the Improved Kenyan Boran (Rowlands 1995).

Role of indigenous knowledge

Adapting animals to new and unfavourable environments requires care and determination. The Tzotzil women of Chiapas, Mexico, developed their own breed of sheep - which are able to survive and produce under very challenging circumstances

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- from stock brought over by the Spanish conquerors (Perezgrovas 1996). The Fulani who inhabit the Sahel zone of Africa systematically and gradually expose animals to tsetse-infested areas, resulting in the survival of cattle in environments that were previously considered unsafe for them (Blench 1999).

But apart from adapting animals to new environments, many indigenous people consciously 'shape' their animals according to their own specific breeding goals and utilization patterns. Pastoral societies, in particular, with their extreme dependence on the productivity of their animals, have developed highly intricate indigenous knowledge systems pertaining to animal breeding.

Indigenous strategies for safeguarding and developing their valuable genetic resources include a variety of social mechanisms. Restrictions against the sale of female animals outside the community are common among pastoral societies, in order to ensure their long-term subsistence base. On the other hand, animals are often freely exchanged within the community, and to some extent are even considered common property. The transfer of ownership is often associated with life-cycle events, such as birth, circumcision, marriage, and death. Stock-sharing arrangements in which user rights are transferred to poor relatives or to friends are common, ensuring that benefits from livestock are distributed more or less equally throughout the community. One such custom is *mafisa*, practiced in Western Zambia, which also prevents inbreeding and can result in upgraded offspring (Beerling 1986).

Inbreeding is fastidiously avoided in many pastoral communities, although not in all of them. Male breeding animals are selected with great care according to a long list of criteria, including vitality and the performance of the female relatives, but also preferences for certain colours or colour combinations. Kenyan pastoralists say they prefer animals with bright colours because looking at them makes them feel good (Njoro & Wanyama 2000). Camel pastoralists are known to practice offspring testing, i.e., deferring the wider use of a stud until its children have shown to be of the desired quality. Castration - to ensure that only the best male animals reproduce - is mandatory in some traditional societies. Pastoralists also study the genealogy of their animals, often tracing their ancestry back many generations and relating them to their own ancestors (Köhler-Rollefson 2000).

Intellectual property protection and the danger of biopiracy

These examples will suffice to demonstrate that indigenous animal breeds are very much the result of active manipulation, and thus represent important human achievements. This intellectual contribution on the part of livestock keepers should now be accorded a corresponding status. In the Sadri Declaration, issued at an international workshop held in November 2000 in Rajasthan, India, to raise awareness of the role of the indigenous knowledge of traditional livestock keepers in the conservation of diversity, participants agreed that indigenous animal breeds should be recognized as a national asset (see at the end of this paper).

The Sadri Declaration represents an important step forward in focusing attention on the need to develop intellectual property regimes for domestic animals. So far this subject has received short shrift in international negotiations on intellectual property rights for traditional communities. While in the case of plant genetic resources there is an international undertaking that seeks to establish Farmers' Rights for holders of traditional knowledge, no equivalent process has been set up to accord such rights to livestock keepers (ITDG 1996; Köhler-Rollefson & McCorkle 2000). This matter is extremely urgent, since efforts are now on by scientists to identify the genes that are responsible for disease resistance. Examples include the trypano tolerance of the N'dama cattle and the worm resistance of the Red Maasai sheep. The latter is of enormous interest to sheep producers in Australia and New Zealand, since the internal parasites which infest their sheep have become practically immune to anthelminthics. Genetic resistance to worms would be a boon to them. With the advances in genetic modification, scientists expect to be able to insert the genes for

disease resistance into high-performance breeds, in order to achieve both productivity and disease resistance (ILRI 1998).
We know that industrial pig- and poultry-breeding companies guard genetic information about their strains like trade secrets. Is it then appropriate to regard equivalent information about traditional breeds as a common good that can be made available to all without any compensation for the pastoralists that have nurtured their animals for generations?
Obviously, this is a very complex and difficult issue with far- reaching implications for the economic survival of traditional livestock keepers and pastoral societies whose identity is rooted in their association with livestock. It urgently needs to become the subject of transparent and informed international debate, involving a broad spectrum of all stakeholders, especially pastoralists and livestock keepers.

"SADRI DECLARATION",
being recommendations passed by the participants of the International Conference + Workshop on Livestock Breeds for Sustainable Rural Livelihoods

Udaipur and Sadri (Rajasthan/India), 1-4 November, 2000

Acknowledging the diverse roles of indigenous animal breeds for sustainable rural livelihoods in India (for food security, soil fertility, draught power, as social and cultural asset, source of income and saving etc), especially in marginal areas, **being conscious** of the threat to domestic animal diversity, (due to government policies, economic pressures, increasing poverty, cultural erosion, etc., and **concerned** about the lack of awareness in all spheres of stakeholders,

we recommend:

1. Policy changes concerning
- access to resources (grazing, water ...)
- changes in emphasis in the curriculum for veterinary + animal husbandry scientists, extension workers, etc. (more emphasis on bio-diversity, conservation of indigenous breeds)
- breeding policy reviews through consultative processes involving all stakeholders
- formulation of land use plans that guarantee land use/rights for indigenous breeds and indigenous, livestock keepers

2. Concerted actions by NGOs, CBOs and communities, including
- networking, documentation, awareness raising and dissemination of information about the situation and advantages of indigenous breeds
- improvement of marketing (niches) for the products of indigenous breeds
- developing of local institutions + breeding organizations

3. Changing/expanding research towards the needs of poor livestock keepers

towards achieving:
- improved economic situation of livestock keepers
- legal recognition of indigenous breeds as national assets
- maintenance of Indian Domestic Animal Diversity (DAD) for the benefit of future generations

Recommendations passed by participants of the workshop Sadri, November 4, 2000

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Livestock biodiversity in the mountains / highlands – opportunities and threats[1]

by Anne Valle Zarate

Introduction

In the following the subject of 'livestock biodiversity' is approached from a holistic perspective that includes ecosystem and cultural components and is not restricted to genetic-biological features. Thus livestock biodiversity is considered in terms of the diversity of, and interrelationships between, genes, species, and ecosystems including a cultural perspective.

The first focus is on remote mountain areas of more than 4000 masl, where herders with multifold traditions and cultures live and unique genetic resources with highly adapted species and breeds can be found. The second focus is on tropical highlands of intermediate altitude that are prone to intensive production with high yielding breeds with a resultant high pressure on local breeds. References are made to examples from my own research in the High Andes and inter-Andean valleys of Bolivia and in the Northern Highlands of Vietnam. The paper covers rangeland-based animal farming in the subnival and upper montane zone as well as livestock-crop mixed farming in upper montane valleys and includes a discussion of a breeding programme for autochthonous microlivestock as a contribution to the characterisation of biodiversity and its conservation through systematic utilisation.

The 'opportunities and threats' for research and development are discussed in terms of the need for applied and committed research involving the skills and the will of farmers and herders in specific regions, and contributing to the solution of present day problems deriving from global climatic, demographic, and socio-economic changes.

Harnessing the Potential of Mountain Livestock Resources

Guinea Pigs in the Andes

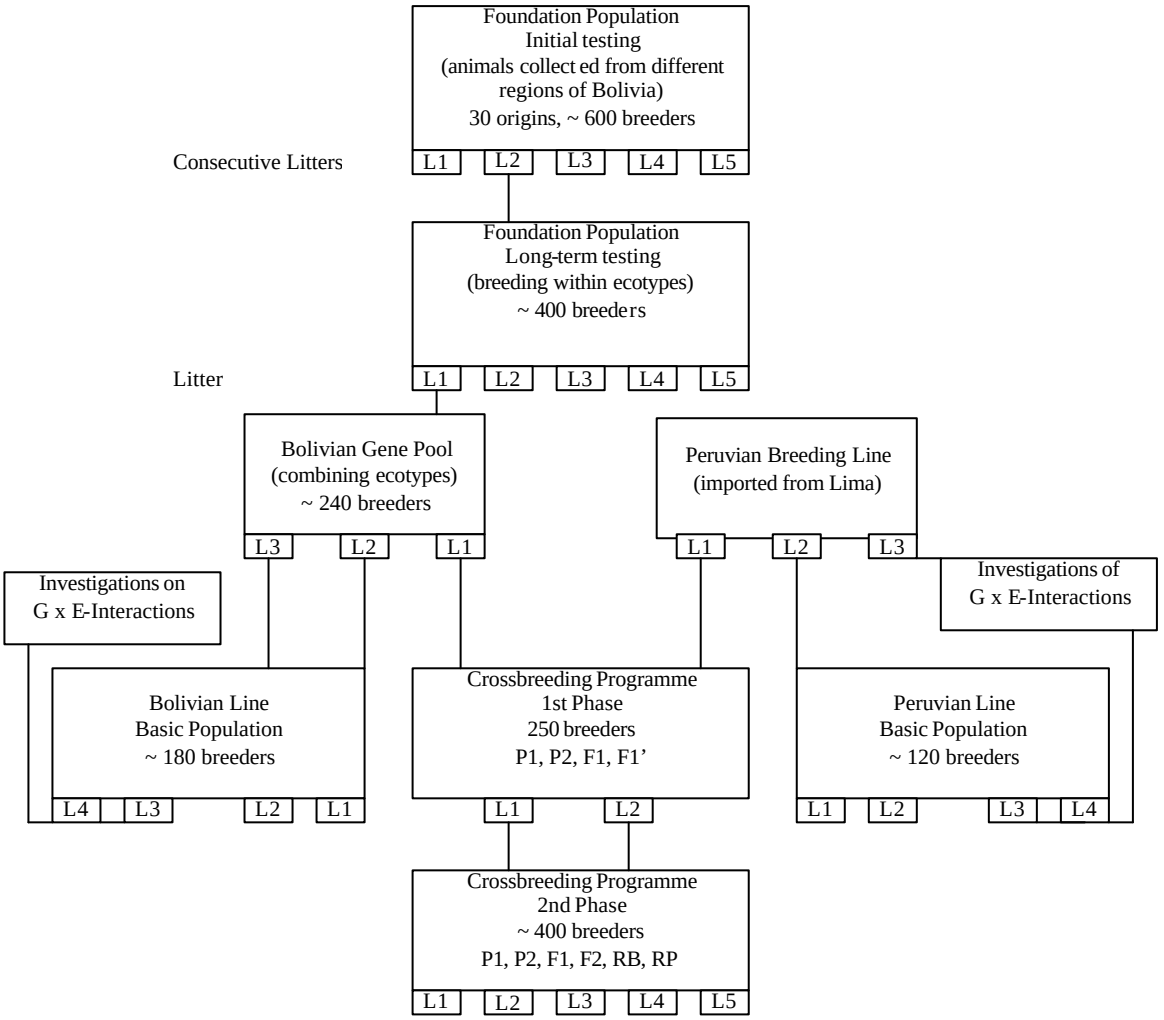
In the late 1980s, a long-term breeding programme was set up in the Andean Valleys of Bolivia for guinea pigs, which are used traditionally for meat. The underlying aim was to characterise the local guinea pig biodiversity and then to conserve it by means of systematic utilisation. Specifically, the main objectives were to investigate the local genetic resources for their potential for meat production and to identify the genetic base for breeding strategies (Valle Zárate 1996a).

The breeding programme comprised the following.

- Screening of regional ecotypes → comparison with improved exotic lines and establishment of a national gene pool
- Implementation of a selection programme → crossbreeding programme
- Testing of genotype-environment interactions → production of improved breeds for use under different conditions

Figure 5.1 shows details of the comparative evaluation process for the local population with comparisons between purebred and crossbred groups and with high yielding exotic stock from Peru.

[1] Originally published in: Pradeep M. *et al*. (eds). 2000. *Contribution of livestock to mountain livelihoods. Research and development issues.* International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal. Pp.71-82. Reproduced with kind permission of ICIMOD, G.P.O. Box 3226, Kathmandu, Nepal.



Source: Valle Zárate 1996a

Figure 5.1: Evaluation of the local genetic resource of guinea pigs in Bolivia as a basis for choice of an appropriate breeding programme

Table 5.1 shows the results of the evaluation of various performance traits of the Bolivian ecotypes (sampled across the country), the Bolivian gene pool (foundation population) and the selected Peruvian line. On first sight the advantages of the exotics over the locals appeared striking with average weight at birth, weaning, and slaughtering higher by 32% to 67%. The exotics were also better than the locals in terms of number and weight of offspring produced in the first litter. However, long-term evaluation of reproduction revealed a different pattern. The locals excelled the selected exotic line both in the number of offspring born and weaned per year and in the total weight of offspring born and weaned per year.

Systematic comparisons between breeding groups kept under different ecological and socio-economic conditions revealed a clear superiority of purebred locals under harsh environments and crossbred animals kept under improved field conditions. Purebred exotics were only superior when kept under conditions of intensive feeding

and husbandry, which are inaccessible for the majority of farmers in mountainous areas.

The results show that local genetic resources play an important role in producing optimised breeding stock for distinct production conditions. Displacement of these resources can best be prevented by identifying environments where they are superior and by combining them systematically with exotic germplasm according to the specific conditions. A prerequisite for the success of the breeding programme was the strict orientation towards the needs of the prevailing farming systems and thorough consideration of aspects of breeding organisation.

Table 5.1: Comparison of selected performance traits for guinea pigs of different breeding groups

Traits (a)	Bolivian Ecotypes		Bolivian Gene Pool		Peruvian Selected Line	
	LSM	(SD)	LSM	(SD)	LSM	(SD)
Bodyweight (g)						
- at birth	85.5	(0.7)	104.9	(2.1)	130.5	(2.7)
- at 14 days	162	(1)	194	(4)	214	(6)
- at 56 days	368	(2)	414	(11)	555	(15)
- at 112 days	501	(3)	595	(20)	835	(31)
Littersize (n)						
- born	2.5	(0.03)	3.1	(0.1)	2.6	(0.1)
- weaned	2.1	(0.03)	2.8	(0.1)	2.2	(0.1)
Litterweight (g)						
- at birth	218	(2)	288	(9)	336	(10)
- at weaning	442	(7)	485	(19)	516	(21)
Dams weight at birth (g)	635	(3)	795	(12)	979	(14)
Interval between litters (days)	73.4	(0.4)	70.1	(0.7)	73.4	(0.9)
Yield per year						
- number of litters (n)	4.2	(0.1)	4.1	(0.2)	3.1	(0.2)
- number of offspring born (n)	10.2	(0.2)	13.1	(0.8)	9.0	(0.7)
- number of offspring weaned (n)	8.2	(0.2)	11.9	(0.7)	8.0	(0.7)
- weight of offspring born	916	(23)	1236	(81)	1133	(77)
- weight of offspring weaned	1680	(47)	2028	(148)	1756	(139)

weaning age: 21 days for local ecotypes, 14 days for improved lines
Test period: 5 litters each
Tested animals: 1223 mothers, 2809 offspring (local ecotypes); 390 mothers, 1759 offspring (improved lines)
Source: Valle Zárate 1996b

The second example relates to specialised livestock production (camelids and sheep) on rangelands at altitudes where cropping is strictly limited or completely impeded, and the conservation of local genetic resources through appropriate exploitation of the livestock biodiversity was targeted. The first step was a long-term evaluation of the prevailing camelid-based farming systems within the fragile environment. The aim was to identify 'desirable attributes' within the local genetic resources and use these to design breeding programmes for their conservation by utilisation (Valle Zárate 1996b). Respect of the herders' culture and special ways, and inclusion of the herders from the first steps of planning and preparation, is paramount for the success of this type of breeding work. The methods used and results of the long-term study are summarised briefly below.

The study was conducted during 14 months in Bolivia in the Wallat 'ani Community (16° 56' S and 66° 32' W), Cocapata Canton, Ayopaya Province, Cochabamba Department, and covered 2000 hectares at 4400 masl in the Cocapata Cordillera. The study focused on 5 families owning 150 llamas, 400 sheep, and 70 alpacas.
The methods applied comprised participating observation, interviews with questionnaires and on range of topics, physical measurement of climate, soil and water, determination of vegetation, measurement of performance of reproduction, weight gain, milk yield, fibre and meat and analysis of hygienic status.

The results of the investigation of livestock husbandry patterns are summarised in Table 5.2.

Table 5.2: Livestock husbandry patterns in a community of herders in the Bolivian Andes

Ownership and Labour Distribution	
Women	sheep, household
Men	llamas, potatoes, alpacas
Main Monetary Flow	
Major income	potatoes, dung occasionally meat, animals, fibre, transport fees, off-farm-labour
Major spending	transport occasionally animals
Contribution of Animals to Subsistence	
Sheep	wool, meat, milk, dung
Llamas	dung, transport, meat, wool
Pastoralism	
Transhumance drastically reduced	
Sheep	herding and enclosure at night
Llamas	free ranging breeding herd kept closer to households castrated animals grazing at distant places
Alpacas	requiring special care as an innovation
Reproduction	
Uncontrolled mating, birth, and weaning High mortality	

Shearing
Mainly November, occasionally May Age at first shearing: ≥ 4 years Frequency: ≥ 2 years Sorting for colour only Prospects for marketing unclear
Slaughtering
Seasonal pattern Old or ill animals
Animal health and hygiene
Infestation by coccidioes (sarcocystiosis) Scabies (*Sarcoptes scabiei*) Lice High occurrence of diarrhoea in foals Traditional and chemical treatments Treatment sporadic and never on all animals affected Indifferent attitude towards animals' well-being
Product utilisation
Low extraction rates of animals, meat, milk, and fibre Dung the product used most systematically and extracted most frequently (fuel, market, products, fertiliser) Sheep dung and potatoes the major products exploited commercially Mainly household consumption of milk, fibre, and meat, and home use of llama dung Declining importance of llamas for transport

Source: Nuernberg and Valle Zárate, 1999

Various characteristics of the fleece quality of the local llama population in Ayopaya were studied and compared with those of a flock from the Andean plains (Condoriri). The results are shown in Table 5.3.

Table 5.3: Significant differences (LS means) between llama fleece traits in mountain and plains region animals

Region	Number of Animals	Mean Fibre Diameter (µm)	S.D. of Fibre Diameter (µm)	Fine fibre (%)	Mean Diameter of Fine Fibres (µm)	Kemp (%)
Condoriri	96	28.0 a	11.7 a	73.3 a	22.8 a	15.2 a
Ayopaya	861	23.2 b	8.0 b	89.3 b	21.2 b	0.8 b

Significant differences are indicated by different letters (Tukey-Kramer $p < 0.05$)
S.D. = standard deviation
Source: Delgado et al., 1999

The Ayopaya llama stock had a very high quality fleece with a high percentage of undercoat and fine fibre of small diameter. The quality was much higher than that of the llama population in the Andean plains, but this advantage has remained virtually unexploited. Currently, breeding activities are in progress with the aim of planning

breeding for conservation and further development of the unique Ayopaya ecotypes of llamas.

Organisation of on-farm conservation programmes for autochthonous pig breeds with small farmers in mountainous regions of Northern Vietnam

The third example of a research project aimed at the maintenance of livestock biodiversity in mountainous regions is concerned with the conservation of autochthonous pig breeds in mountainous regions of Northern Vietnam (Lemke et al., 2000). This project is carried out in collaboration with scientists of the National Institute of Animal Husbandry in Hanoi and focuses on the organisation of on-farm conservation of indigenous breeds. Purebred reproduction is accomplished by means of contracts between farmers and the research station. Different types of contracts are studied, for example with logistically favoured farms, who receive higher prices for their services in reproducing breeds economically not best suited to their farming conditions, and with logistically disadvantaged farms in remote mountainous areas, where the breeds make sense in the farm context but the costs of gathering performance records are increased. This example highlights the necessity of an interdisciplinary approach with a permanent interaction between researchers and the herders and farmers indispensable to programmes for the conservation of livestock biodiversity, especially in mountainous areas. Scientific approaches will only prove useful and sustainable when they are placed in the proper context, incorporating scientific analytical tools and technical skills in local processes of decision making.

Factors influencing livestock biodiversity: Discussion

The following discussion focuses on the interrelationships between livestock biodiversity and nature conservation, sustainable development, indigenous knowledge, and property rights.

Livestock biodiversity as a component of nature

As yet, little has been done to characterise livestock resources, whereas continuous attempts are being made to replace them.

- Government policy is to upgrade and replace local types with improved stock.
- The purity of native types is being lost in some areas through informal programmes carried out by the farmers themselves (Wilson 1997).

Livestock biodiversity versus nature conservation

The worldwide assumption underlying the focus on conservation can be expressed as follows.

Human land use for subsistence leads to degradation and is incompatible with the maintenance of high levels of biological diversity. Therefore more inclusive conservation policies within and beyond protected area boundaries are imperative while recognising

- the difficulties associated with implementing restrictive policies, and
- the fact that human land use practices may not lead to degradation or to a decline in biological diversity (Saberwal 1996).

Livestock biodiversity pro nature conservation

- Advantage must be taken of the valuable interaction between livestock and natural resources.
- At present, overgrazing of some mountain pastures and undergrazing of others (as a result of the depopulation of animals in environmentally difficult areas) have resulted in land degradation.

- Ecological studies to determine optimum stocking densities should be carried out in each region in order to facilitate sustainablity, biodiversity, and nature conservation measures. Appropriate adjustments should be made in pastureland management regulations and appropriate incentives given to farmers (Zervas 1998).

Livestock biodiversity and sustainable development

The general compatibility of on-farm conservation efforts with livestock development approaches has been shown recently by

- Joshi and Rasali (1998),
- own results and experiences as cited above, and
- Somlo (1997), who reported the results of two projects in Argentina showing the possibility of conservation of environment and biodiversity by means of sustainable development. The projects were concerned with pasture management and livestock production, and livestock and forestry development, respectively, and were aimed at improving food production in an area with special problems and providing opportunities to change from a condition of absolute poverty to one of self-sufficiency with dignity.

Conservation of livestock biodiversity must be included when defining 'sustainablity' because

- the maintenance of the natural capital stock is a minimum condition for sustainable development (Orlove and Brush 1996), and
- sustainability includes aspects of ecological sustainability such as environmental, sustainability and maintenance of biodiversity, as well as ethical and economic sustainability (Torp-Donner and Juga 1997).

Livestock biodiversity, indigenous knowledge and property rights

The following are already in common practice:

- The use of indigenous knowledge for rapidly assessing trends in biodiversity (e.g. Hellier et al, 1999; case study from Mexico)
- Recommendations of the sort as from the study on 'The importance of genetic diversity in livestock populations of the future': 〈Maintain an aggressive program of sampling and evaluation of exotic breeds with potential for immediate use〉 (e.g. Notter, 1999). It is looked for favourable alleles in otherwise lowly productive stocks. It is intended to utilize this cryptic variation as a contribution to future selection response.

Pertinent considerations to be made are the following:

- Distance measures describing similarities due to common ancestry should be used only as an initial criterion in making breed conservation decisions (Barker, 1999).
- Biodiversity and indigenous knowledge systems under new intellectual property regime should be recognized (Dobhal, 1999).
- Much depends on the local knowledge of agriculturalists as to the importance of different species and the conditions of their survival. Thus it is not only important to preserve this diversity but also to avoid the acquisition of local knowledge by developed countries becoming expropriation of this local knowledge without proper reward (Gomez Benito, 1995).

Threats and Opportunities: Conclusions

Threats (challenges)

- There is still a very powerful tendency to replace local livestock resources with ill-adapted high-yielding exotics.
- Much work remains to be done in the characterisation of the performance and special traits of local breeds.
- Genetic impact analysis is not yet routine in areas where exotic breeds are used, neither in the choice of the appropriate level of intensification of breeding and production, nor in the re-evaluation and worldwide diversification of breeding goals.
- There is a common belief in the competence of the international scientific system to come up with simple solutions for the complex problems of specific local people and ecosystems. However, the solutions offered are often technically narrow and short-term and result in

  -the investment of available funds mainly in (aggressive) programmes for sampling and evaluation of exotic breeds with potential use elsewhere; and

  -decisions about which breeds, strains, or ecotypes should be conserved being taken on the basis of mostly questionable, narrow approaches to the description of genetic diversity.
- The importance of livestock biodiversity as an integral part of nature conservation and sustainable development, particularly in fragile and globally important ecosystems such as the mountain areas, still tends to be overlooked and the implications neglected.

Opportunities

- There is increasing recognition of the important role of livestock keepers in safeguarding domestic animal diversity through their animal husbandry (Hall 1996).
- After decades of development debacles with alien breeds, scientists and developers have at last come to appreciate the vast animal genetic resources that ordinary farmers and herders have developed through the ages, especially in the South (McCorkle 1999).
- Many rural societies are confronting the loss of biological diversity and culture. Fortunately, there are also many examples of rural people strengthening their knowledge, traditions, and spirituality to meet the needs of the next millennium (Dankelmann and Ramprasad 1999).

In order to encourage and empower local people to continue keeping their unique genetic livestock resources in ecologically fragile, globally important environments, it is necessary that herders and farmers in programmes of biodiversity conservation and regeneration are directly involved and supported in the following.

- Decision making, planning, and implementation
- Direction of funds to the specific sites of action
- Provision of legal support and assistance for problems related to property and utilisation rights
- Provision of subsidies for such things as landscape protection services in situations where farmers and herders are encouraged to develop extensive production systems with local genetic resources on the basis of local fodder rather than opting for individually more profitable intensive high-input, high-residue production systems

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Part 4. Resources

Organisations

As this dossier is about development in the South, it does not include organisations focusing on Europe and North America.

Organisations with regional or international focus

Breeds of Livestock
Department of Animal Science
Oklahoma State University
Stillwater, OK 74078-0425, USA
Website:
http://www.ansi.okstate.edu/breeds/

Runs a database on different breeds of livestock.

CYTED Network
Iberoamerican Network for the Conservation of Domestic Animal Resources
International Coordinator: J. V. Delgado
Universidad de Veterinaria
Departemento de Genetica
Universidad de Cordoba
Avenida Medine Azahara 9
14005 Cordoba, Spain
Email: idledebej@uco.es
Website:
http://www.uco.es/grupos/cyted

Food and Agriculture Organization of the United Nations
Domestic Animal Diversity Programme
Viale delle Terme di Caracalla
00100 Rome, Italy
Fax: +39 6 5225 5749
Website: http://dad.fao.org/

FAO is publishing the World Watch List for Domestic Animal Diversity and the periodical Animal Genetic Resource Information. They have produced a large amount of materials providing useful background information, including videos and CDs. FAO guides the implementation of the *Global Strategy for Management of Farm Animal Genetic Resources*.

FAO Regional Office for Asia and Pacific
Maliwan Mansion
39 Pra Atit Road
Bangkok, Thailand
Tel: +662-697-4000
Fax: +662-697-4445
Email: FAO-RAP@fao.org
Website: http://www.fao.or.th

FAO/UNDP/SADC Farm Animal Genetic Resources Management Programme
Private Bag XI38
Pretoria, South Africa
Tel +27(0)12-319-7424
Fax +27(0)12-329-7220
Email: Sadc-fangr@fao.co.za
Website: http://www.sadclgr.un.org.za

See Part 1 and 2 for an example of their activities.

German Technical Cooperation (GTZ)
Management of Agrobiodiversity in Rural Areas
P.O. Box 5180,
65726 Eschborn, Germany
Website: http://www.gtz.de/agrobiodiv

The agrobiodiversity programme of GTZ is promoting the concept of "community-based management of animal genetic resources" (CBMAnGR) and has published a series of booklets on this and related topics. The information is also available on their website.

Imperial College at Wye
University of London
Wye, Ashford, Kent TN25 5AH, UK

The Agroecology Unit of Imperial College at Wye is offering a long-distance course in the "Conservation of Animal Genetic Resources" and is conducting research on peoples' conservation, mainly in Latin America.

Intermediate Technology Group (ITDG)
Myson House, Railway Terrace,

Rugby CV21 3HT, UK
Website: http://www.itdg.org

ITDG has published a series of three booklets on "Dynamic Diversity" and has been a very active mover in pushing for "Farmers Rights" and the International Undertaking on Plant Genetic Resources.

International Centre for Integtrated Mountain Development (ICIMOD)
G.P.O. Box 3226
Kathmandu, Nepal
Website: http://www.icimod.org

ICIMOD helps to promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations in the Hindu Kush-Himalayas.

International Livestock Research Institute (ILRI)
Animal genetic resources
International Livestock Research Institute
P.O. Box 5689, Addis Ababa
Ethiopia
Website: http://www.cgiar.org/ilri

ILRI has done extensive work on Africa's indigenous breeds. Information about its work can be gleaned from the ILRI website as well as their annual reports and newsletters.

League for Pastoral Peoples (LPP)
Pragelatostrasse 20
64372 Ober-Ramstadt
Germany
Website:
http://www.pastoralpeoples.org/

As co-initiator of the LIFE initiative, LPP has conducted research on indigenous knowledge and perceptions about animal breeding and breeds. It would like pastoralists and other traditional livestock keepers to receive credit for their crucial role in upholding domestic animal diversity.

Local Livestock for Empowerment of Rural People (LIFE)
Mr. W.M.K. Warsi
Lokhit Pashu-Palak Sansthan
Desuri Road
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District Pali, Rajasthan, India
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Website: http://www.lifeinitiative.org

LIFE is an "initiative, a movement and an approach" for involving the prime stakeholders in all efforts for conserving indigenous breeds.

Overseas Development Institute (ODI)
Portland House
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Website: http://www.odi.org.uk

ODI has published several papers on livestock biodiversity, especially with reference to West Africa.

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RBI is a global non-governmental organization for the conservation of farm animal genetic resources. It organizes a global conference every three years.

National organisations

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List of abbreviations

AHW	Animal Health Workers
AnGR	Animal genetic resources
BAIF	Indian Development Research Foundation
CAST	Council for Agriculture Science and Technology
CBD	Convention on Biological Diversity
CBMAnGR	Community Based Management of Animal Genetic Resources
CGIAR	Consultative Group on International Agricultural Research
CIWF	Compassion in World Farmers Trust
COP	Conference of Parties
CSO	Civil Society Organisation
DAD	Domestic Animal Diversity
DAD-IS	Domestic Animal Diversity Information System
EEC	European Economic Community
FAO	Food and Agriculture Organisation
GO	Governmental Organisation
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
FPR	Field Performance Recording
ICCD	International Convention to Combat Desertification
ICIMOD	International Centre for Integrated Mountain Development
IDA	International Development Aid
IDC	Indian Dairy Corporation
IEI	Instituto de Estudios Indígenas
IIED	International Institute for Environment and Development
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
IPR	Intellectual Property Rights
ISGP	Indo-Swiss Goat Project
ITDG	International Technology Development Group
LIFE	Local Livestock for Empowerment of Rural People
LPP	League for Pastoral Peoples
LPPS	Lokhit Pashu-Palak Sansthan
MoA	Ministry of Agriculture
NARS	National Agricultural Research System
NGO	Non-Governmental Organisation
ODI	Overseas Development Institute
OED	Operations Evaluation Departments
RBI	Rare Breeds International
SACCAR	Southern Africa Centre for Cooperation in Agricultural Research and Training
SADC	Southern African Development Community
SRISTI	Society for Research and Initiatives for Sustainable Technologies and Institutions
UNACH	Universidad Autónoma de Chiapas, México
WFP	World Food Programme
WTO	World Trade Organisation
WWF	World Wide Fund For Nature

Glossary

Agrobiodiversity. The spectrum of all plant and animal breeds and species used in agriculture.

Animal genetic resources (AnGR). Collective name for the whole spectrum of animal species and breeds and their genetic information. Commonly used to refer to domesticated animals only.

Breed. In the north, this is understood as, “a group of animals with definable and identifiable external characteristics that distinguish it from other groups within the same species”. In the south, it refers to a group of animals belonging to the same species that is kept by a particular community in a specific environment and subjected to the same utilisation pattern.

Domestic animal diversity (DAD). Collective name for the whole spectrum of domesticated animal species and breeds and the genetic information they contain.

***In situ* conservation.** Conservation within the native habitat or an environment similar to this.

***Ex situ* conservation.** Conservation approaches outside of the breed’s natural habitat – for example, in zoos and in gene banks.

Gene. A special substance in the body’s cells (building blocks) determining how an animal looks and develops. An animal’s genes are a combination of the genes from both parents.

Local breed. A breed that is adapted to a specific habitat and has been shaped, often over centuries, by the cultural preferences of a particular community or ethnic group - in contrast to an ‘international’ high-performing breed produced through very intensive selection for very specific traits, often with the use of biotechnologies.

Species. A group of animals that freely breeds with each other and produces fertile offspring. Example: Donkey and horse are different species. Although they may be able to interbreed, their offspring (mules) are not fertile.