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The Need to Conserve Farm Animal Genetic Resources Through Community-Based Management in Africa: Should Policy Makers be Concerned? — Source link

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The Need to Conserve Farm Animal Genetic Resources Through Community-Based Management in Africa: Should Policy Makers be Concerned?

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SUMMARY

This paper outlines some key factors contributing to the erosion of animal genetic resources and discusses strategic options for livestock sector policy makers to counter such erosion in their respective countries.

The ratification of the Convention on Biological Diversity (CBD) in 1993 represents an international consensus to conserve biodiversity including that of farm animal and plant genetic resources, which are prerequisites for food security and the improvement of agricultural productivity. In Africa, conservation of agricultural biodiversity is inbuilt into the low input – low output production strategies of smallholder farming systems. These systems are often associated with poverty in rural areas and numerous development projects have thus sought to alleviate such poverty by promoting and subsidising crossbreeding or modern reproductive technologies. However, uncontrolled crossbreeding has been and remains a serious threat to the conservation of local farm animal populations.

The primary policy goal for conservation of biodiversity should focus on the diversity between and within indigenous populations of farm animals. This includes, for example, the close monitoring of crossbreeding activities with exotic breeds. The genetic and phenotypic characterisation of local breeds is a prerequisite for this purpose. Economic valuation of biodiversity in general, of breeds within given production systems and an analysis of the social welfare implications of farm animal genetic resources (FAnGR) diversity conservation although relatively complex to carry out are also important for informed policy making. Despite the difficulties involved, objectives for the conservation of a local farm animal population and opportunities to utilise its diversity to meet present and future market demands, to serve as an insurance against environmental changes such as changes in production, socio-economic, historic and cultural conditions can be identified for research and development. To improve food security through the conservation of animal genetic resources in Africa, utilisation of local farm animal genetic resources depends on the ability of communities to decide on and implement appropriate breeding strategies. This cannot be realised without enabling policies. It is for this reason policy makers need to be concerned and should take action now.

Keywords: Farm animal genetic resources, breed, community-based management, policy development, conservation, diversity

NON TECHNICAL SUMMARY

This paper outlines some key factors contributing to the erosion of animal genetic resources (AnGR) and discusses strategic options for livestock sector policy makers to counter such erosion. It is argued that to improve food security through the conservation of AnGR will depend on the ability of communities to decide on and implement appropriate breeding strategies. This cannot be realised without enabling policies. An action plan for conservation of AnGR is proposed for policy makers in Africa. This should include, *inter* alia, the removal of perverse incentives, controlled crossbreeding and the promotion of decentralised community-based management and full stakeholder participation.

CONTENTS

The need to conserve farm animal genetic resources through community-based management in Africa: Should policy makers be concerned?

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1 Introduction

The ratification of the Convention on Biological Diversity (CBD) in 1993 represents an international consensus to conserve biological diversity, including that of farm animal and plant genetic resources, which are the prerequisites for food security and the improvement of agricultural productivity. The CBD is a legally binding treaty and includes agricultural areas. It is not a convention to protect the environment per se and to maintain the status quo but it recognizes the need for integrating conservation and the sustainable use of natural resources. The CBD provides, therefore, a framework for developing a specific sub-sector policy for farm animal genetic resources (Laing et al., 1998). The CBD implies that, while nations own their biological resources, they also have a duty to conserve them. Policy integration is acknowledged in the CBD and the governments need to integrate "the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies" (Article 6b, CBD). The integration of such programmes into national policy-making, the creation of national or 'bioregional' ownership, which could even be translated and developed into rights, and the active participation of farming communities are all elements of key importance for the success of such programmes. Major factors contributing to the loss of diversity are market and intervention failures that affect farm animal genetic resources (FAnGR) in livelihood and market oriented agricultural systems. This calls for a new research programme looking into economic valuation of animal genetic resources (ILRI, 1999a). However, the collection of sufficient data and testing of various methodologies will require considerable time. Phenotypic and genetic characterisation data for most of the domesticated animal species are insufficient to make well-informed decisions on the allocation of limited funds for national conservation programmes targeting indigenous breeds across species. On the other hand, action needs to be taken as a matter of urgency due to the ongoing loss of FAnGR. Unavailability of appropriate data is no justification for taking a 'wait and see' approach. The aim of this paper is to outline key factors contributing to the erosion of FAnGR and to discuss strategic options for livestock policy makers to enable community based management (CBM). This paper focuses on sustainable use policies, strategies and actions through CBM, targeting farm animal populations in their natural habitat as the way forward under African conditions.

2 Definitions of community, breed, diversity and conservation

In the context of conservation of FAnGR, 'community' can be defined as a group of people bound together by common interests, goals, problems or practices and, usually, farm animals. Geographically speaking a community can be of any size comprising a village area, an ethnic group or an eco-regional zone. There is no objective definition of the term 'breed', which is often used in the context of animal genetic resources.

The meaning becomes even less clear when the term 'indigenous' is used to qualify communities or knowledge, a practice, which is very popular in actual development programmes. 'Breeds' are subjective classifications according to common utilisation patterns, habitats, degrees of the openness of the gene pool or the assessment by their owners. Breed development has been closely linked to the formation of breeding societies in the early 19th century in western countries (Lloyd-Jones, 1915). FAnGR, again, is not a very precise term but probably it is the best to reflect the situation. Often, the approach to the conservation of biodiversity and conservation of a breed or FAnGR is not identical. Biodiversity as an entire system and breed as the assumed unit to preserve diversity are conceptually different from each other. The stratification of species into breeds is not well established for most species. While for Africa more than 140 cattle breeds are listed (Rege, 1999) the corresponding number for pigs or pigeons is probably much less. Does this mean there is less diversity in other species than in cattle? This is unlikely and we should be very careful about taking the number of breeds as the only measure of biodiversity within species. Further, we should differentiate between genetic diversity within species and diversity between species. In the common situation of developing countries, which is characterised by little stratification of species into well defined breeds, a considerably larger share of the within species diversity may be allocated within rather than between the existing breeds. What is not being questioned here is that communities use names and are able to differentiate between existing animal populations due to phenotype or geographical location. The need to conduct an objective inventory of various species and their stratification is obvious. The risk is, however, that policies may focus on few individual breeds but forget about the goal of conserving diversity and utilisation of FAnGR.

Ex-situ conservation, the dominant strategy in plant genetic resources (PGR), is of limited practical relevance for conservation of FAnGR in Africa. Lesser (1998) states, that the complex institutional mechanism for PGR set up by FAO, the inclusion of the 'Farmers' Rights' concept and the development of a Global Plan of Action made the system less transparent for potential users and countries, and prevents use of indigenous varieties. Comparing the situation in plant genetic resources, where over 1200 plant genetic resource collections worldwide contain an estimated 4.2 to 6.1 million accessions (Lesser, 1998), the ex-situ approach for FAnGR is obviously not a relevant strategic option for Africa. Governments hold 83 %, the Consultative Group on International Agricultural Research (CGIAR) system 11% and the private sector the rest (6%) of the plant genetic accessions according to Lesser (1998). The eleven gene banks of the CGIAR centres, however, keep the most unique collections with about 35% of unique samples, and hold in trust more than 600,000 accessions. In Africa, a pragmatic and innovative strategy for the conservation of wildlife, which has proven to be successful, is through its sustainable use (Krug 1997). The in-situ conservation utilisation of FAnGR through CBM is possibly the most cost-efficient method of choice in developing countries with a potential to contribute to food security and household income improvement of the livestock keeping community.

3 Key factors contributing to the erosion of animal genetic resources

Historically, epidemics, inter- or crossbreeding, civil conflict and migration of people caused extinction of breeds or strains. Indiscriminate interbreeding or crossbreeding and civil conflicts are in fact the major causes of breeds or strains being classified as at risk in Africa. Rege (1999), for cattle, and Epstein (1971), in earlier work for other domesticated species of Africa, provide numerous examples. Small effective population size is a result of genetic erosion. Small populations are at risk if no measures are taken. The estimation of the effective population size (N_e) offers the possibility to use one objective indicator for monitoring and planning purposes. N_e is calculated using the number of females and males used for breeding in a population (Falconer and Mackay, 1996):

$$N_e = (4N_m N_f) / (N_m + N_f)$$

The rate of inbreeding increases as effective population size decreases. An effective population size of less than 50 for a given strain or breed, leads to high inbreeding coefficients (F>1%) per generation and results in decreasing reproductive and productive performance. Such populations are vulnerable to sudden or persisting environmental threats. Comprehensive breeding programmes or simple action plans for the genetic improvement of local populations avoiding genetic erosion are absent in most African countries (Wollny, 1995).

Crossbreeding programmes are intended to improve biological and economic efficiency. A structured and controlled crossbreeding programme requires considerable infrastructure and is a complex undertaking. There is some evidence of functioning small-scale enterprises utilising crossbred dairy cows in Kenya (ILRI 1999b). The net benefits of crossbreeding may have been overestimated in general (Ayalew et al., 2001; also see paper by Karugia et al. in this same issue). The impact on genetic diversity of cattle species, however, has not been analysed yet. No ex ante or ex post impact studies are currently available, which have analysed the distorting effects of subsidies on the competitive advantage of indigenous breeds in the market place. In general, crossbreeding was and still is perceived as "the way forward" to improve productivity of indigenous livestock under smallholder conditions and development policies have largely ignored adapted FAnGR (ILRI, 1999a). Often livestock policies encourage short-term solutions, e.g. promotion of 'exotic' breeds and their crosses through centralised provision of exotic x local F1 animals to farmers. This policy of 'improvement of local farm animal populations' is often simply a synonym for crossbreeding or substitution of indigenous animal genetic resources by 'exotic' animals. In many African countries bilateral or multilateral financed development projects were the driving forces to replace existing indigenous populations through 'improved' animals as discussed in Drucker et al. (2001). In most developing countries a project initiates a crossbreeding programme by providing free technical advice and some financial input. The exotic genotypes are not selected for the specific crossbreeding purpose in a different production environment. After the initially well-controlled project phase the schemes are often characterized by a more or less unplanned import or use of exotic genetic material, which is used to "upgrade" local breeds. In centralised programmes, the smallholder farmer depends on the supply of the crossbred animal, which is most often a F1 female animal. At farm level, planned mating schemes may not function as intended due to insufficient sire exchange, breakdown of the artificial insemination system, the poor extension service or high transaction costs. After the establishment of the F1 generation recombination losses occur in subsequent generations. The following generations express reduced productive advantage while the problem with insufficient adaptation remains. The offspring of the perceived 'improved' animals may not even survive in low-input and high-stress environments. The implementation of crossbreeding schemes under smallholder farming conditions without threatening indigenous populations appears unrealistic, if no measures are taken. It is obvious that uncontrolled crossbreeding is a real threat to local FAnGR. Although donors or governments cover the initial costs of such programmes, the longer-term risks and consequences are borne by the farmers.

The lack of valuation of FAnGR could be considered as another significant factor contributing to genetic erosion. A national policy should promote and enable the valuation of the genetic resources for two main reasons: a defined value can be instrumental in providing an incentive for conservation and, secondly, supporting the identification of the optimum allocation of funds for promoting in-situ conservation. Providing incentives to intensify the use and development of local breeds could well be a sustainable strategy. Attaching values to unique traits of specific breeds, i.e. genes or gene combinations, however, is a very difficult task. In principle, a quantifiable value of a gene or a gene combination carried by indigenous populations is determined by how rare the gene is and its perceived future usefulness. Economic values are useful with regard to making decisions about the allocation of resources to promote and develop FAnGR. A high estimated value of an existing genetic resource for future use may draw the attention of national policy makers. In the absence of economic estimates for indigenous or local populations or unique traits, governments or international donors are much less likely to provide financial incentives to farmers to promote conservation. Actual programmes are based on economically, socially and politically biased arguments, which are detrimental to the conservation of FAnGR diversity. This is the situation we are facing in the conservation of FAnGR.

4 The need for characterisation of FAnGR

Conservation measures for populations that have reached a critical size might even be necessary before a detailed genetic and phenotypic evaluation and economic analysis can take place. Ruane (1999a) determines the degree of endangerment as the most important criterion for breed prioritisation in a decision-making framework. It should be noted, however, that the 'cut-off' point for the critical effective population size is both species and population-specific. Factors such as the herd or flock sizes, mating structures, introduction of 'improvement programmes' through crossbreeding in an adjacent area, mortality rates, epidemic occurrence of diseases, market developments and price changes and other external factors may put a given farm animal population at risk of extinction. From the perspective of conserving inter- or intra-species diversity, interventions in favour of or against a single specific breed or strain can be misplaced or counterproductive. For example, allocation of funds to provide incentives to conserve a given population under threat of extinction may contribute much less to the conservation of diversity than incentives provided to a less endangered but more genetically distinct population (see Weitzman, 1993). At the next layer of diversity the variation between and within species is of importance. The fact that only a few breeds of some species are known compared to, for example cattle, cannot simply be interpreted as that the species consisting of less 'breeds' is less diverse. Decisions on the allocation of resources should not be based only on an assumed or estimated value of a certain breed within species only but should follow a systems approach.

Genetic and phenotypic characterisation of locally available farm animal populations provides essential information to make rational decisions for the improvement and the development of effective breeding programmes. In an attempt to classify cattle populations of sub-Saharan Africa by various criteria and incorporating indigenous knowledge, Rege (1999) and Rege and Tawah (1999) identified 47 breeds or strains out of 145 which are at risk of extinction. Recent microsatellite studies provide phylogenetic explanations to the extent that previous assumptions on centres of domestication of cattle need to be revised (Hanotte et al., 2000). Their study is based on molecular genetic methodology studying the frequency of a Y specific microsatellite locus. The authors concluded that human migration, phenotypic preferences by the pastoralists, and adaptation to specific habitats and to specific diseases are the main factors explaining the distribution of cattle breeds in sub-Saharan Africa. This information explains the existing diversity and provides justification to invest in the conservation of indigenous breeds from an international perspective.

Policy makers cannot wait until very specific and detailed breed or strain information is available. Phenotypic characterisation provides basic evidence for the variation between and within cattle strains, which could be utilised for selection purposes. Ruane (1999b) criticises the present over-emphasis on expensive genetic distance studies, the current difficulties in validating such results, its uncertain value in providing initial information for decision-making in conservation and the imbalance between molecular studies and cheap and rapid phenotypic characterisation. By contrast, locally conducted studies in Tanzania (Stephen et al., 2001) provided evidence of assumed genetic differences of local sheep strains, which provides justification for and probably motivates the communities and organisations to develop such adapted and distinguishable breeds.

Nevertheless in Africa, the collection of sufficient field data based on phenotypic monitoring of representative populations in the absence of a systematic recording scheme is probably more expensive than the collection of tissue samples followed by molecular analysis.[1] The ideal situation is to have available phenotypic data, which includes biological, performance and economic data and molecular information. New data resulting from molecular genetic technology or GIS application may reveal important information about unique traits or population dynamics in future. In the short-term, and under the pressure of time to conserve and utilise the remaining indigenous breeds, rapid surveys and the estimation of population sizes by species and breed/strain, together with the identification of the distribution pattern within agro-ecological zones would provide sufficient initial information for policy makers to obtain an overview of the national livestock herd and to formulate an initial national plan to conserve the existing farm animal populations in their habitat. In the almost complete absence of validated breed definitions across species and insufficient application of standardized evaluation protocols for either genetic or phenotypic studies in Africa, the decision-making process on FAnGR is not practicable if it is uniquely related to individual breeds or species. Instead, the highest priority should be given to conserve the diversity across species and breeds or strains. A pragmatic way

[1] However, it should be appreciated that such studies are normally carried out at international research centres. Often the results are likely to be overlooked by national planners.

forward could be the intensified use of local livestock populations targeting farmers in their communities as the key strategy for maintaining genetic diversity.

5 Community-based management of FAnGR

Intra-species diversity of indigenous livestock animals is a function of natural selection and random or systematic human interventions. Traditional practices of livestock keeping communities probably involve multiple breeding goals including multipurpose use, aesthetic and behavioural aspects. One of the main attributes of indigenous breeds is their adaptation to the production environment. Village communities may have different needs, perceptions and preferences by which they make decisions for mating or sale of animals. The ability to survive natural calamities, the prestige value and capital asset function are important aspects, which need to be incorporated into a comprehensively defined breeding goal. Restrictions or taboos, mating practises, progeny testing or replacement of stock are often closely linked to the religion or culture of the people. There are no systematic or comprehensive observations on traditional animal breeding systems and practices that have been published, despite the fact that this is a researchable issue. A national policy should enable and promote such research involving the farmer in a participatory way. The integration of systematised indigenous knowledge into a scientifically based conservation strategy could improve acceptance livestock owners and local decision makers. This approach is also emphasized in the CBD in article 8 (j).

5.1 Community and village breeding schemes

The literature on community-based or village breeding schemes is scanty. Soelkner et al. (1998) analysed determinants for success and failure of village breeding programmes citing various examples. A village breeding programme is characterised by smallholder farming communities, often at subsistence level, combined with a low probability of changes in the environment, i.e. major constraints of disease, feed and land shortage are prevailing. Systematic recording of performance or animal identity is usually not taking place. If any selection is taking place, than the selection is often not directional, its goals are not defined and probably differ within and between farming communities. The critical information required is with regard to the livestock owners' decisions affecting selection of animals (i.e. understanding how, why and when). The production system must be better understood in the context of other farming or off-farm activities before any successful community-based programme could be initiated. In fact, most farming environments in African developing countries continue to deteriorate due to pressure from human population growth and land degradation. Breeding programs will most often operate in an environment, which is not improvable in terms of production factors. For example, El Waakel and Astake (1996) and Mwendera et al. (1997) describe the stressful environment for humans and their livestock in the Ethiopian highlands. Under such conditions the adaptive value of indigenous breeds is most likely to be rated as very high. Conservation policies and programmes based on the assumed condition that positive environmental changes will be successfully implemented may not be realistic. A site-specific approach utilising the existing resources and taking into account the given constraints appears to be the only reasonable sustainable solution.

The importance of the level of human-livestock interaction is complex but often not considered in development policies and projects. Neidhardt et al. (1996) distinguish between livestock users, who have a purely exploitative relationship with their animals, livestock keepers, who provide some input, and livestock breeders, who have a historically well-founded relationship and implement selection and controlled mating. There is evidence in numerous reports (for example Rischkowsky and Steinbach, 1997; Simpson, 1999; also see Soelkner et al. 1998 for various project mission reports) that 'unwillingness' to change from a livestock user to a livestock keeper or breeder is a major factor in intervention failure. This resistance to change is based on risk adverse behaviour, which is most likely the best strategy from a farmer's point of view in coping with erratic climatic conditions or insecure market conditions. In subsistence oriented agricultural systems, the transaction costs, which include the cost of the exchange of agricultural products, handling and marketing costs etc., are often too high to attract farmers to sustain specialised or intensified livestock systems (Delgado, 1997). Access to education, information, health and knowledge are further constraints preventing intensified use of existing resources. It appears that the sociological factor of human-livestock interaction is not fully considered in the planning and implementation of livestock improvement policies. Livelihood-oriented livestock farming systems are risk-averse and therefore the investment is spread through keeping smaller, but more numerous and diverse species. Farmers are risk-averse and plan for themselves rather than for the national market. This is a logical decision under the existing harsh conditions, although it may be at odds with the national goal of increasing production output and efficiency so as to ensure sufficient food supply at adequate prices for the population at large.

5.2 Production output versus adaptive fitness

In an unchanged production environment the increased probability of losing an animal which is more productive, yet more susceptible to disease and environmental stress, is often not considered when planning conventional improvement programmes involving crossbreeding, as unrestricted feed supply and sufficient health care management are usually assumed. Risk aversion could be addressed through selection for adaptive fitness as an important aim in a breeding plan. Adaptive fitness is characterised by survival, health and reproductive related traits. The problem is that selection for low heritable and difficult to measure traits and the underlying antagonistic biological relationship between productive performance and fitness will result in low selection responses for fitness-related traits. The appropriate strategy for any breeding programme would therefore be to set suitable selection goals, which match the production system rather than ambitious performance objectives, which cannot be reached under the prevailing environment. If selection is based only on one output oriented trait, e.g. body weight gain, the assumed antagonistic relationship with other important traits such as health or reproduction related traits may negatively affect the overall biological and economic efficiency of any breeding programme.

The definition of a breeding goal based on a participatory process is an essential step for a village or community based conservation programme. The policy, therefore, should promote decentralised decision-making and ensure the participation of animal owners among other stakeholders in the process of formulating a breeding goal. The starting point should be the definition of a breeding goal (Wollny, 1995). Groen (2000) provides detailed guidelines on stepwise characterisation of the animal production system and how it relates to development of breeding programmes. The paper, however, does not refer to the overall goal of conservation of animal genetic resources and assumes that choices could be made for breeds in a market-oriented production system.

5.3 Breeding schemes for indigenous farm animals

Measurable genetic gains could possibly be achieved through formation of group breeding schemes, which require the full participation and the long-term commitment of the livestock owner. The basic steps would include the clear definition of terms of membership, an agreement on objectives of the breeding scheme, the selection criteria or traits and the formation of a breeding or foundation stock. Traditionally, mating decisions are based on ancestral performance rather than progeny testing. This would allow the use of biological indices as selection criteria representing a comprehensive breeding goal (Soelkner et al., 1998). The use of such an index – one which is as simple as possible – could be used for the screening process of the initial population in a breeding program. A nucleus-breeding scheme is characterised by keeping the screened animals on one location under identical environmental conditions. If after the foundation of the initial nucleus herd inflow of genetic material is permitted either through selected animals from other herds, or semen or embryos, then the nucleus is called open.

Open nucleus breeding schemes (ONS) could be an appropriate technological strategy for genetic improvement in developing countries. Bondoc and Smith (1993) proposed, for example, a scheme for dairy cattle in developing countries. The analysis of an open nucleus-breeding programme for sheep in Ivory Coast indicated that expected genetic progress could be realized, if management and selection pressure are maintained (Yapi-Gnaore et al., 1997). Iniguez (1998) analysed breeding programmes for small ruminants in the Andean region of South America and concluded ONS would fit community-breeding programmes well, if it were well integrated in the production process. The cause for the collapse of externally initiated and funded breeding programmes after subsidy provision ceases is most likely not the inadequate initial funding but the inadequate involvement of the community. Chagunda (2000) discusses a dispersed open nucleus scheme with animals not physically located in any one place and allowing the inflow of external germplasm into the system. Such a system would have a number of advantages:

- the dispersed open nucleus has no size limitations and the threat of high inbreeding levels is low;
- the nucleus is located within the production environment and potential genotype-environment interactions are therefore minimal or non-existent;
- direct farmer participation is possible and farmers manage and control their own animals;
- efficient utilisation of infrastructure is possible;
- the promotion of a dispersed open nucleus system would fit in well with the trend of decentralisation and privatisation of government farms in several countries;
- the controlled mating of crossbred animals could be improved through organizational development of farming communities;
- the breeding programme for farm animals could be combined with in-situ programmes for plant genetic resources (PGR).

In practice the establishment of such a programme would require the implementation of a monitoring and recording system, the processing, analysis and interpretation of data, and feedback to the farmer on a continuous basis. Further, the number of selected breeding animals in such a system must be relatively high to achieve a positive genetic gain through selection and to ensure flow of improved genetic material to all production herds or flocks. The major disadvantage or technical problem of a so called dispersed ONS is that breeding animals are most likely kept under slightly different conditions and exposed to different management levels resulting in uncontrolled variation, which cannot be adjusted for. This would significantly reduce the potential genetic gain.

In Malawi a community based project on improving and sustaining food self-sufficiency through promoting integration, multiplication and intensified utilisation of indigenous rural poultry was initiated (Gondwe et al., 2001). ONS breeding centres will be established in rural communities and managed by a committee of farmers. The farmers and other community-based stakeholders are fully participating in all aspects and the community committees make all decisions. Two breeding and multiplication centres were established, with an additional set-up at a college farm to conduct complementary trials. Breeders from within the community will multiply and distribute indigenous breed stock to other farmers. Different species and strains of locally available poultry (chickens, pigeons and ducks) will be raised and performance evaluated at the centres. Distribution of selected animals to production flocks will be through the traditional stock sharing system.

Sustainable conservation of FAnGR in their natural African habitat requires breed development, which can best be achieved through a participatory approach with the communities and stakeholders involved. It is obvious, that the views, goals and knowledge of the livestock owner should determine the level and intensity of a breeding scheme or programme. An enabling conservation policy, therefore, should place high priority on a community-based participatory approach.

6 FAnGR related policies, objectives and instruments

In many cases publications on the management of animal genetic resources (FAO 1999 and 2000) focus on ‘breed’ and neglect cultural and other socio-economic factors, which form the production environment. Most likely the creation of strong identification of the farming community for their FAnGR conservation programme is a key strategy if it is ever to be successful in Africa. Development and implementation of national policies for the conservation of farm animal populations are competing with other pressing issues and it cannot be realistically assumed that livestock-oriented policies will rank very high on the priority list in future. A successful policy on conservation of FAnGR must therefore be embedded in an overall development strategy and integrated with the policies on PGR.

Typically, policy objectives and decisions relate to mechanisms for ensuring low priced food products to consumers and improved food security, while providing incentives for promoting exports and investment in the development of the local livestock population. An instrumental FAnGR policy will additionally need to promote the active participation of the rural population.

We can identify four areas of policy making related to conservation of FAnGR:

1. Regulation of new technologies, considering local capacity and promotion of appropriate technologies;
2. Monitor and control import and export of germplasm of FAnGR;
3. Economic incentives;
4. Intellectual property rights and their enforcement .

1. New technologies and capacity building: In industrialised countries the development of new technologies related to animal genetics is predominantly a private sector activity, whereas most of the conventional technologies for livestock improvement are available in the public domain. The major constraint for adoption is human capacity to assess and to implement appropriate technologies. Consequently, the technology transfer potential between developed and developing countries cannot be fully utilised by the national agricultural systems (NARS). The non-profit organisations of the CGIAR should be encouraged to have closer collaboration with development-oriented programmes in order to enable faster technology transfer in Africa. Emphasis should be placed on scientifically sound methodologies for evaluating indigenous knowledge in animal breeding and how this could be incorporated into innovative breeding programmes. It is obvious that government policy should enable and promote the capacity for training and research in the area of animal breeding and molecular genetics at higher and intermediate level. Also impact assessment requires an interdisciplinary approach and regional co-operation and networking are essential.

2. Migration of germplasm: Historical analysis and recent data provide sufficient evidence that indiscriminate use of exotic germplasm has dramatic effects on genetic erosion (Iniguez, 1998; Hanotte et al., 2000). In most developing countries of Africa the import of exotic germplasm and the conducting of crossbreeding programmes is poorly controlled and managed at the national level. Crossbreeding or development of synthetic breeds may have advantages in certain contexts such as in peri-urban dairy production. However, the impact on genetic diversity of FAnGR must be monitored and controlled. A clear policy on crossbreeding, which takes the need for conservation of FAnGR into account, is therefore required. It should be compatible with the goals of conservation of genetic resources and fair and liberalised market development, so as to remove any direct or indirect incentives for the introduction of exotic breeds.

3. Economic incentives: In accordance with the CBD it is recognised that users and beneficiaries should pay the full value of the resources they use. This would include at least some externalities. From a pragmatic point of view the provision of direct and indirect incentives to utilise indigenous animals could possibly lead to a self-sustaining conservation programme. The promotion of marketing facilities, establishment of revolving funds for group breeding schemes, open nucleus or adequate grading systems would all be considered components of an enabling policy. Providing access to pastures for pastoralists, where appropriate, promotion of livestock clubs and recording systems, the promotion of formulation of adequate breeding objectives, and the development and co-ordination of decentralised breeding programmes should form additional key elements of a national livestock policy plan. Support to develop local products, value-added products or specific labels could be a

further strategic option to convert a market failure into a market success for local breeds. The most effective option, however, is probably to remove restrictions affecting local breeds and their products and to remove incentives promoting use and import of exotic genotypes.

4. Property rights: The discussion on intellectual property rights (IPR) raises very controversial issues although it has thus far been largely focused only on plant genetic resources (see Lesser 1998; FAO, 2001; IFPRI, 2001). The failure of existing property rights systems in plant genetic resources to provide protection and benefits to a local community is one of the more contentious issues of the CBD. IPR and patenting will become an issue although patents are not granted for an entire plant or animal organism and the costs are prohibitive. IPR protection is applicable to animal genetic material with unique characteristics or for some characteristics, which can be induced through technological procedures, as specified by national and international patent regulations. A financial system would then be required to assist local communities, and procedures and regulations for the actual transfer of genetic material needs to be worked out. However, there is little hope of getting such a system functioning and for plant genetic material a sui-generis system is proposed (Lesser, 1998), which conceptually separates ownership of genetic material from ownership of knowledge. It can be argued, that a policy claiming general property rights for FAnGR material appears to be of little benefit at present. The bulk of the genetic material is of no known use or function and has no present market value. Restrictive national policies on international research of animal genetic resources and their exchange are short sighted. Recently, policy statements providing a framework for the use of genetic resources, intellectual property rights and biotechnology were issued by the CGIAR centres (CGIAR, 1999). The aim of such a statement is to ensure that important genes or gene combinations are maintained in the public domain. In contrast, claiming unspecific property rights for the protection of indigenous genetic resources, which cannot be enforced, would appear to be useless and counterproductive to development. The potential value of a gene is correlated to knowledge and not the gene per se. Material transfer agreements, as practised for plant genetic resources could be drafted, if there is any doubt by the provider on the future use of the sample taken. At present most African countries have little means and inadequate infrastructure to implement legislation on IPR for FAnGR. On the other hand policy makers must become sensitive to the option value of indigenous FAnGR. A precautionary measure, e.g. applying a safe minimum standard (Bishop, 1978), of maintaining the FAnGR as any other natural resource would enable policy makers to develop adequate access legislation and genetic material transfer agreement as a response to new discoveries in biotechnology in the future.

7 Conclusion

At present the indigenous FAnGR of Africa are perceived as inferior and few economic values have been defined. This perception is in sharp contrast to reality. The significant dependence of the majority of the human population on indigenous livestock populations and the direct human-livestock interaction is a fact for Africa. Research methodologies on valuation of FAnGR, indigenous knowledge and how farmers and other stakeholders could participate in this process are in development.

Further advances of biotechnology will possibly result in commercialisation of genes or combinations of genes and a value could be acquired. The discussion on intellectual property rights will become more relevant as soon as biotechnology has derived identifiable products from indigenous farm animal genetic resources. Lessons learned from policies on plant genetic resources may help in the formulation of policies but need to be specified for animal genetic resources, which are more complex. At present, genes determining unique traits are non-tradeable and should remain in the public domain controlled by independent organisations. Any restrictions will negatively affect scientific progress. This development needs to be closely monitored by national policy makers in future.

The efficient utilisation of indigenous farm animals by maintaining genetic variation and minimizing counterproductive effects of livestock production on the natural environment appears to be the most pragmatic and sustainable strategy option. Removal of perverse incentives, combined with controlled crossbreeding is a strategic option of high priority. A policy promoting decentralised community-based management and full stakeholder participation is likely to support a sustainable conservation and development strategy of FAnGR in Africa with a high degree of identification with the programme.

Diversity of FAnGR is not static but dynamic. The challenge is to avoid further erosion of adapted or unique populations and the replacement by genotypes, which are not competitive under the given or future environmental conditions. The improvement of food production derived from animals is simply not feasible without conservation of FAnGR and their important characteristics and traits. This is why policy makers need to be concerned and need to formulate enabling policies.

8 Recommendations

An action plan for conservation of FAnGR is proposed for policy makers in Africa:

- Formulate guidelines to ensure that the issue of maintaining FAnGR and their intensified utilisation are factored into investment appraisal and policy appraisal within and across the agricultural sector.
- As a first step remove direct, indirect or perverse incentives such as subsidising non-indigenous farm animals, and if deemed appropriate underpinned by a ‘regulatory safety net’.
- Develop guidelines for livestock projects and programmes to avoid uncontrolled crossbreeding reducing genetic diversity.
- Identify priorities by ranking competing interventions on the basis of cost-effectiveness.
- Identify and select instruments, which minimise costs for conservation but maximise benefits for the utilisation of FAnGR.
- Promote the undertaking of inventories of FAnGR by stakeholders.
- Empower communities through promotion of decentralised decision-making and formation of farmer organisations.
- Screen existing sector policies for compliance with the goal of maintaining and utilising FAnGR.
- Promote institutions of the national agricultural system to implement policies and provide data for rational decision-making.

- Provide a framework for the fair marketing of indigenous livestock and their products through labelling, certification, investment incentives or removal of inadequate grading systems for indigenous livestock products.

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