

**POLICY
PAPER
14**

Conservation and Management of Genetic Resources of Livestock



**NATIONAL ACADEMY OF AGRICULTURAL SCIENCES, INDIA
December 2001**

Conservation and Management of Genetic Resources of Livestock

Introduction

The diversity of livestock genetic resources is very wide, both in variety and variability in terms of species, breeds, populations and unique genotypes. This diversity has been recognised as a vital resource for sustenance of mankind. Judicious utilisation and enhancement of the quality of these resources is important to ensure their sustainability to meet future demands.

The Indian subcontinent is amongst the 12 mega biodiversity resource centres in the world where domestication of flora and fauna took place in the antiquity. The spectrum of bio-diversity is exceedingly vast and varied in this subcontinent. In domesticated livestock and birds, a large number of breeds/types of cattle, buffaloes, sheep, goats, pigs, horses, camels, mithuns, yaks, dogs, cats, poultry, ducks, geese, turkeys, guineafowls and pheasants have evolved over time through natural selection and some human effort.

From the Vedic to the post-independence period, improvement in livestock has been made to meet changing demands. The primary thrust in cattle has been on draught. However, with the introduction of mechanisation in agricultural operations and rural transport, the relative importance of draught has decreased considerably in large farms and may further decrease in future. It is likely that this situation will extend to small farm holdings too. Consequently, there will have to be a major shift in terms of utilities of bullocks, which have been, till lately the backbone of traditional system of agriculture and rural transport. This shift will have to be taken into account while developing policies for improvement and conservation of cattle.

The NAAS organised a workshop* on 'Conservation and Management of Livestock Genetic Resources (LGR)' at GB Pant University of Agriculture and Technology, Pantnagar, in association with the Department of Animal Husbandry and Dairying (DAHD).

The workshop considered and debated issues relating to current livestock production systems, the present status of livestock genetic resources, strategies for conservation, technology platform and the improvement framework for future. The workshop discussed ways and means of making the livestock genetic resources as sustainable inputs into the economic and social development process such that they become wealth and employment generating enterprises of the future.

Current Status and Future Demand

Animal production contributes about 40 per cent of the total value to agriculture globally. Two billion people depend, at least in part, directly upon livestock for their livelihood. The 4,000-5,000 breeds/populations provide a broad variety of meats, milk and

* More than 210 academics, activists, researchers, non-government organisation representatives, government officials, and representatives of industry from India, together with a number of scientists from other countries participated in the workshop.

eggs, together with a broad range of other goods and services, such as draught, fibre, hides, skin, manure, etc.

With appropriate management, livestock enable sustainable use of marginal lands for food production, transforming otherwise unusable fibrous material into high quality protein. When poorly managed, particularly in fragile production environments, livestock species become one of the causes of desertification which is not due to the livestock per se but to human inability to manage the livestock and vegetation resources in an integrated manner. It is therefore, necessary that sustainable use and further development of these resources is well planned and managed. Human population growth, progressive urbanisation and larger purchasing power of people will increase demand for livestock products. Delgado *et al.* project a growth in total consumption of meat and milk at 2.9 and 4.3 per cent per year, respectively, for India. In absolute terms this converts to 170 million mt of milk and 40 mt of meat by 2020 AD.

Considering future trends in demand and supply of livestock products and services, attention for genetic improvement will be required both for indigenous and exotic breeds. Although, there is a need to utilise between-breed genetic differences through crossbreeding for higher yields, greater emphasis is required on improvement of adapted indigenous breeds/types because of valuable adaptive traits they have developed over long periods of time through natural selection.

Continued human population pressure, economic advancement leading to growing demands for foods of animal origin, and environmental factors affecting lands will require sustainable intensification of livestock production to meet increasing human demand. This can succeed only when the livestock genetic resources are adapted to the prevailing production environment. Where changes to the production circumstances occur steadily over time, the indigenous adapted livestock genetic resources possess better biological capacity to respond to the new conditions. Where major production system changes are proposed to be introduced within short periods, superior genetic resources from elsewhere in the country or from similar production environments of other countries will be required. For example, with much improved genetic evaluation and deployment, genetic material developed under high-input, low-stress, short life-cycle production environments of developed countries has made valuable contribution to expanding the higher input, 'softer' production environments of India.

Two main considerations will guide future activities: (1) the conservation of livestock genetic resources and maintenance of diversity and (2) substantial increases in rate and efficiency of livestock production. The current and future challenge is how to effectively generate increased output per unit of input from livestock sector while preventing major loss in genetic diversity and environmental degradation.

Production Systems

The locally adapted indigenous breeds commonly show low absolute levels of production. However, productivity itself is often remarkably high, when proper account is taken of the production environment, the level of input and the length of the production lifecycle. Indigenous breeds survive, produce and reproduce in environments under which

they have been evolved. The medium and low-input production environments common in India, face several environmental stress factors.

Different production systems are in existence in different regions of the country. No macro- or micro-level studies of input-output functions have been undertaken in respect of these production systems, nor has any study been conducted on output of livestock products. These production systems are characterised by specific socioeconomic structure of the society including caste, religion and social status. Many are driven by various ecological considerations. It is important that these systems are studied at both macro- and micro-level, and impact assessment of different livestock production systems is made on livestock and their products. Constraint analysis including strengths, weaknesses, opportunities and threats (SWOT) of different production systems is necessary for developing strategies for conservation and management of livestock genetic resources.

The migratory system of livestock raising for sheep, goats and cattle is an age-old tradition. This system involves movement across states and countries. How this system has influenced structure and function of currently available sheep and goat breeds should be studied and documented, so that new innovations consistent with social change can be introduced which cause minimal hardship to stakeholders but lead to larger benefits.

Livestock resources in India are undergoing unprecedented changes due to introduction of new technologies. Issues arising from these changes need to be identified and examined, so that effective solutions can be found to inevitable problems.

Technology Assessment

Major changes in livestock production have occurred during the past few decades due to introduction of several new technologies, e.g. control of diseases like rinderpest, artificial insemination, embryo transfer, and associated technologies (genomics, cloning and transgenesis). These speed up reproduction, shorten the gene recovery process and enable more efficient genetic improvement.

Despite the present low efficiency and high cost of cloning, this technology will have a major impact on the conservation of livestock genetic resources. Once practical sampling protocols are developed for important farm animal species and they become financially viable, the entire improvement and conservation platform will change. It is, therefore, necessary that research in newer biotechnologies is intensified, so that traditional genetic improvement methods like progeny testing and sire/dam selection schemes are bypassed in future. This is particularly relevant to India and other developing countries, where large data collection and its management is expensive and unreliable.

It will be necessary to identify key policy issues and options which are likely to affect the access, development and utilisation of such new biotechnologies in relation to the management of livestock genetic resources. These policy issues include access to knowledge and information generated by new biotechnologies, intellectual property management, access and benefit sharing, regulatory issues, international collaboration in the conservation of LGR and public perceptions and ethical issues.

At present, no framework is available within a single international instrument regarding policies on access, utilisation and conservation associated with the application of biotechnology to animal genetic resources. Although, several international instruments provide pieces of policy guidance, they need to be reviewed for crafting consolidated guidelines which are cohesive and comprehensive.

Strategy for Conservation of Livestock Biodiversity

A number of methods have been used for conservation of livestock genetic resources. These include *in situ* conservation of the breeds/populations, cryopreservation of semen, ova, embryos, skin, blood, DNA fragments, etc. These methods are relevant when the breed is rare or near extinction. In India, the situation is not so acute as to call for large-scale *ex situ* conservation efforts. What is, however, necessary is technology evaluation and perfection at selected institutions which can be used whenever and wherever required.

It is recommended that research institutions of ICAR, agricultural universities and other research laboratories initiate programmes to study and identify valuable adaptive traits at all levels (phenotypic, genotypic, DNA/RNA levels) and locate structural genes/QRTs responsible for these traits. Special emphasis should be laid on: resistance to various diseases, resistance to harmful endo- and ectoparasites, tolerance to large fluctuations in quantity and quality of feed, tolerance to non-availability of adequate quantity and quality of drinking water, tolerance to extreme temperature, humidity and other adverse climatic factors, adaptation to low capacity management conditions, ability to survive, regularly reproduce and produce for long periods of time.

The viability of a livestock genetic resource programme is enhanced when it focuses on traits that increase the economic value of the breed to the communities involved. The assumption is that the model of economic value provides for all inputs and outputs from the herd or flock, over time. A number of approaches have been used to stop or reduce the decline of livestock genetic resources, and these models can be mutually supportive for short- and long-term insurance. 'Wise use' forms a highly desirable form of conservation. The maintenance of a breed in its environment also satisfies the requirements of Article 8 of the Convention of Biological Diversity, which gives first priority to *in situ* conservation. It is suggested that 'wise use' should form the basis for framing conservation policies.

Cryo-conservation as a means of maintaining breeds, should also be considered where specific animal genetic resources are at risk of loss because farmers have not been profiting from their use under the preventing production circumstances *in situ*. One of the most useful aspects of cryo-conservation is its supportive role in genetic upgradation of breeds.

Realising that no clear-cut guidelines are available within the present system of governance and management of resources in India, the strategy has to combine genetic improvement and conservation of resource.

It is necessary that identification, characterisation, evaluation and documentation of the livestock genetic resources are completed in the next five years. A complete description of each breed should be generated on the basis of different profiles including

habitat distribution, physical conformation, adaptation, production, reproduction and socio-economic aspects.

Information on demographic distribution of breeds, their population trends and utilisation patterns should also be generated quickly. National and state livestock census should be conducted on breeds and information on ecologies in which they perform.

A complete database should be developed on populations of different breeds within each livestock species of the country. The database should also identify factors threatening the extinction of breeds.

The National Bureau of Animal Genetic Resources (NBAGR) has a significant role to play as a nodal agency for different aspects of breed characterisation and conservation. NBAGR should develop a time-bound action plan for breeds to be surveyed and characterised and determining conservation needs and strategies.

Differences in number of breeds of a species listed in literature published by different authors from India as well as from other countries, including FAO, has created confusion about the exact number of accredited breeds within each species. A panel of expert animal geneticists should be established in the Department of Animal Husbandry and Dairying of Government of India to list all descript breeds of different livestock species and to evaluate the entire data before granting accreditation. An estimate of value of each breed in its own native environment needs to be worked out so that proper assessment of its sustainable management can be planned.

The basic strategy will have to be, conservation through sustainable improvement and management. This will involve selection for important economic traits. A district-level improvement plan, with village as a unit will have to be devised. A village-level committee should be established which functions as Breeders' Association Unit, and is responsible for bull selection. This association/society/unit should try to maintain: (i) listing of all animals of each farmer, (ii) birth and death register, (iii) health cover register, (iv) breeding register and (v) monthly milk record register. All adult males not used in breeding should be castrated and for each castration the farmer should receive a reasonable compensation. A district-level monitoring committee, which will provide technical guidance and will involve district animal husbandry officer and all veterinarians in the district should be established. This will meet the WTO requirement for import and export of livestock and its products.

There may be situations where crossbreeding with an exotic breed needs to be resorted to. Under these conditions, it is essential to upgrade the production system. A well-defined breeding plan should be developed to avoid problems of future degeneration. Every effort should be made to ensure that the livestock farmers move from subsistence farming to a financially viable livestock enterprise. They should get access to credit on low interest rate from financial institutions and arrangements should be made by the Breeders' Association to provide services and goods as required and a sustainable market for the product.

If a breed is identified as rare or in danger of extinction, the farmers who maintain the animals of such a breed should get compensation at the rate of profit earned through

crossbreds. The village group/association/society should also arrange to take up marketing of animal products.

The management and conservation of domestic animal diversity is very costly. For developing people's participation in the conservation strategies, Government of India must provide incentives to farmers.

Human Resource Development

Scientific and technical manpower must be adequately trained for correct and critical identification of each breed, its description based on phenotypic and genetic characteristics including the production environment. It is regrettable that there is no action plan for capacity building and human resource development in this sector. The Department of Animal Husbandry and Dairying, in conjunction with Indian Council of Agricultural Research, must come up with an R&D and HRD plan for this sector.

Utilisation of Genetic Resources

The national policy for management and improvement of livestock genetic resources should have clear aims and objectives and these should be based on analysis of livestock population, breeding structure, disease problems, availability of feed resources, changes in social structure, sustainability of production system in terms of market demand of products and prices. Sound genetic resource utilisation policy, relevant to different farm animal species under different input systems need to be prepared by Department of Animal Husbandry and Dairying, Government of India in consultation with State Animal Husbandry Departments, Indian Council of Agricultural Research, State Agricultural Universities and other stakeholders.

Animal Breeding Policy

The breeding policy, which must include mechanism of livestock conservation, needs a special debate with wider participation of stakeholders. Similarly, Animal Biodiversity Bill, before finalisation, should be given wide publicity to generate debate to make it more effective in the context of conservation of animal genetic resources. A policy framework needs to be established under which conservation and vertical genetic improvement are linked in a manner that leads to reduction in animal numbers.

Legal Issues

Legal measures relating to conservation of livestock genetic resources are non-existent in India. Appropriate legal instruments need to be worked out to cover all aspects of breed utilisation, conservation, trade and marketing. It will be necessary to have a legal framework to regulate mandates and operations of livestock farms of government or government supported institutional herds. For example, *goshalas* and *gosadhans* should be declared as national gene banks and be involved in breed conservation and improvement programmes.

In the WTO structure and IPR regime, access to genetic resources and their transfer is becoming restrictive. Restrictions on export of genetic resources out of India should be

considered in a manner that does not hinder reasonable exchange. Similarly, it should be ensured that access to new technology is not denied to us and our institutional structure is strengthened to face a denial, if and when resorted to. For this, efforts should be made to build new institutions in the area of animal biotechnology devoted to cell cloning, embryo fusion, nuclear fusion, gene grafting, gene transfer between species and within species and futuristic sciences. A technical cell needs to be established in DAHD on IPR and WTO issues where competence is available for examining these issues and suggesting appropriate responses and legal solutions.

Convention of Biological Diversity (CBD)

For appropriate alignment to CBD process we should take the following measures:

- Assess the relationship of IPRs to access and benefit-sharing provisions, including development of guidelines or best practices for achieving equitable benefit-sharing from use of genetic resources. In particular, we should pay attention to mechanisms, such as certificates of origin, evidence of prior consent for accessing genetic resources, evidence of prior approval of indigenous and local communities for access to traditional knowledge, and disclosure of this evidence in patent applications.
- Evaluation of the impacts of international processes relating to IPRs, including TRIPs, on the objectives of Article 8 (j) of the CBD.
- Development of a protocol on the protection of indigenous and local community knowledge and resource rights.
- Providing inputs into the ongoing WIPO processes on 'new beneficiaries' which are assessing issues relating to protection of traditional knowledge and development of a code of conduct, or a protocol, on access and benefit-sharing, especially in relation to the resources and knowledge of indigenous and local communications, and of developing countries.

Traditional knowledge

Emphasis should be given to identify, collect, collate and comprehend the traditional knowledge available for the maintenance of various grazing and wasteland ecologies and the animal genetic resources on sustainable basis. The diversity in animal genetic resources (AnGR) has been maintained in India for a very long time (3,000 years) on the basis of traditional wisdom of our farmers. This traditional knowledge should be documented and researched. Traditional practices should be blended with modern methods to allow maintenance of livestock on natural feed/fodder resources in hill/desert/plain ecosystems.

Database Management

For breed characterisation work, methodology, sample size and data analysis package suitable for field data must be generated and standardised. The NBAGR should prepare a breed directory and an animal watch list for regular monitoring of livestock

genetic resources by Department of Animal Husbandry and Dairying, Government of India. The data bank facilities are very good at the NBAGR, but feedback of data from resource agencies is very poor. It should be made mandatory by funding organisations, while sanctioning projects in animal husbandry, to send one set of data to the national animal data repository at NBAGR.

The NBAGR is undertaking the breed characterisation and conservation programme in collaboration with other ICAR institutions/state agricultural universities, under a network programme. Such linkages need to be developed with state AHDs, NGOs and other stakeholders also, to expand this effort.

Species Specific Recommendations

General

There is large genetic diversity in livestock as reflected in important domesticated species and a large number of known and lesser known breeds/strains. It is imperative that extensive surveys be undertaken in the home tracts of the known breeds for their description and evaluation and identifying the need and approach to their conservation and improvement. Where the numbers are extremely small, immediate efforts should be made to conserve those breeds, preferably *in situ*.

Species-wise recommendations for breeds, which require priority attention for conservation, are as follows:

Cattle

Cattle breeds such as Red Sindhi and Sahiwal which have their breeding tracts in Pakistan and Tharparkar, for which we share the breeding tract with Pakistan, are available with a few institutional herds and private breeders. They should be further improved and conserved. Similar attention should be given to Gir, Kankrej and Ongole breeds of Gujarat and Andhra Pradesh. These could be utilised in grading up of non-descript cattle under harsh environments.

Lesser known breeds of cattle such as Punganur, Red Kandhari, Vechur, Bhagnari, Deoani, Lohani, Bengal, Chitagan Red, Nepalese Hill, Kachcha Siri, Tarai, Lulu, Sinhala, Umblacherry and Gangateri need to be studied as genetic resource and steps taken for their conservation and improvement.

A number of new breeds such as Frieswal, Karan Swiss, Karan Fries, Sunandini are in various stages of development from a crossbred base. Their further improvement and conservation is necessary.

Buffalo

Murrah and Nili Ravi are two most important breeds of buffaloes. They need to be improved further. Other important buffalo breeds, *viz.* Surti, Jaffrabadi, Mehsana, Bhadawari, Nagpuri, Pandarpuri, need to be studied and improved through selection.

Lesser known breeds such as, Kaziranga, Toda, Marathwadi, Sambalpuri, Kalahandi and Paralakhemandi would require extensive survey for their description and evaluation followed by improvement and their conservation if required.

Sheep

Of the 42 breeds of sheep, all the breeds of Jammu & Kashmir and other indigenous breeds like Pugal, Nilgiri and Garole need immediate steps for preservation.

Goat

Of the 20 breeds of goats, Jamnapari, Barbari, Beetal and Surti are threatened by extinction and would need steps for conservation. These breeds have played an important role in genetic improvement of goats. Other breeds of goats like Black Bengal and Osmanabadi also need to be studied and improved.

Camel

In addition to four important breeds of camel *viz.* Bikaneri, Jaiselmeri, Kuchchi and Mewati, there are lesser known breeds such as Marwadi, Mewadi, Sindhi, Shekawati. There is a need for proper description, evaluation, conservation and improvement of these breeds.

Horse

Little efforts for description and evaluation of indigenous breeds of horses and donkeys have been made. Breeds like Marwadi, Kathiawadi, Zanskari and Spiti are some important breeds which need immediate attention for conservation and improvement.

Donkey

Nothing is known of genetic variation in donkeys in spite of their large variation in phenotypic characters. There is a need for conducting surveys for description and evaluation of different types of donkeys available in the country.

Pig

There is a large variation in pigs as reflected in size, colour, performance, etc. There is a need for proper description and evaluation of these types and steps need to be taken for their conservation and improvement.

Yak

Little is known about the genetic resources of yaks. There are differences in size and reproduction performance of yaks located in different regions. These differences need to be studied and utilised in conservation.

Mithun

Little is known about the genetic resources of mithun with respect to their physical conformation and performance and pattern of domestication. There are differences in size of mithuns found in different parts of North-Eastern states. Studies for description and evaluation of these types should be undertaken.

Poultry

A number of species of poultry viz., chicken, duck, guineafowl and quail, make important contribution to food and income. There is large genetic variation in these species, which are required to be characterised and utilised for improvement and their conservation.

Pet Animals

Description and evaluation of indigenous and exotic breeds of pet animals (dogs, cats and birds) need to be undertaken and their improvement requires immediate attention, as these species are becoming very important as pet animals for household and other useful purposes for policing, defence and other duties.