

Conservation of Animal Genetic Resources

By

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1. Introduction:

I would like to compliment the International Buffalo Federation for organising the second world Buffalo Congress in India which has the largest buffalo population in the world. This Congress would help to focus better attention to the conservation and development of buffalo genetic resources in this and other countries where buffalo makes a substantial contribution to nutrition security and to the rural economy.

Interest in the conservation of plant genetic resources has tended to be more widespread thanks to the demonstration of the scientific and economic significance of such conservation by N.I. Vavilov about 65 years ago. Consequently, an International Board for Plant Genetics Resources (IBPGR) is now functioning under the aegis of the Consultative Group on International Agricultural Research. The FAO Council also established a Commission on Plant Genetic Resources in 1983 when I was Independent Chairman of the Council. The establishment of these bodies has helped to develop priorities and action programmes in the collection, conservation and evaluation of plant genetic wealth in a systematic, scientific and sustained manner. Based on this information, it is now widely realised that conservation of living natural resources like plants and animals and non-living elements of the environment on which they depend is crucial for development.

Sustainable development is the key to enduring food nutritional security. Only then, the progress achieved today will not be at the expense of prospects for a prosperous agriculture tomorrow.

Livestock occupies an important position in the national economy of most of the developing countries. This is particularly so in India. In India as well as many developing countries, mixed farming involving crop-livestock integration has been a way of life since the beginning of agriculture. Also it is widely realised that this is the only method of providing additional remuneration and employment to the small farmers and landless labour families. In fact, a great challenge before animal production experts in countries like India is the standardisation of technologies which will help landless labour families to derive economic benefit from a land based occupation like animal husbandry. Obviously this will call for high stability systems of stall-fed farm animal management. Socio-economic motivation becomes essential for generating the requisite political and public commitment to conservation particularly in poor nations where there are many competing demands for the limited resources available. While soil erosion attracts attention since it is visible to the eye, the erosion of valuable genes in animals and plants tends to get ignored until a disease epidemic, or some other production problem for which genetic solution is necessary, crops up.

The conservation of genetic resources is assuming greater relevance with the opportunities opened up by genetic engineering and biotechnology.

... Also, today's gene pool may not be the ideal gene pool of tomorrow in view of fast changing consumer preferences and projected climate changes. ~~wharax~~ Combined with genetic conservation needs, equally important are the vital life processes carried out by nature, including stabilisation of climate, protection of waste-lands and soil, preservation of nurseries and breeding grounds etc. Conserving these processes cannot be divorced from conserving the individual species within the natural ecosystems. Managing the species and ecosystem together is clearly the most rational way to approach the problem of animal genetic resources.

Since my experience has been largely concerned with the agrarian economy of India, I shall deal with the conservation of animal genetic resource conservation in the context of its socio-economic and scientific significance to India.

2. Role of Livestock sector in income and employment generation in India.

The livestock sector is an important allied sector of crop production in the Indian agrarian economy. According to the National Accounts Statistics the gross value of output from this sector at constant 1970-71 prices was equivalent to about 6.36 billion US \$ in 1984-85. It accounted for 18 per cent of the total gross value of output from agriculture and allied sectors. The output from this sector recorded a steady rise during the one and a half decade ending in 1984-85 registering an overall growth of 59 percent at constant prices. Table 2.1 gives the trend during the last 15 years.

The share of livestock in the agriculture and allied sectors increased from 15.4 per cent in 1970-71 to 17.98 in 1984-85 with the highest record of 18.67 in 1979-80.

Not many are aware of the magnitude of contribution made by livestock to the development of the country. Market value of 192 million cattle, 70 million buffaloes, 144 million sheep and goats and 10 million pigs, two million horses and camels, and 200 million poultry works out to about Rs. 45,000 crores. Their value of output is also of the same order, giving a capital-output ratio of 1:1. Item-wise break-up of output, in thousands of crores of rupees is - milk 15, work 10, dung 9, meat 6, eggs 2, skin and others 3. Livestock contributes 10 per cent GNP which may be much more if the real value, or replacement cost, of dung and work is taken into account.

The livestock sector provides gainful employment to a large work force. The 1961 census which attempted comprehensive coverage of workers enumerated 3.84 million workers in this sector constituting 2.04 per cent of total work force. The 1971 census emphasised only the main activity in the enumeration of workers and thus yielded work force figure not comparable to 1961 census. Adjusting for this deficiency, the work force in this sector in 1971 is estimated at 4.31 million showing a rise of 12.2 per cent in the decade. The distribution of work force by broad industrial divisions including livestock sector for 1961, 1971 and 1981 (adjusted) may be seen in Table 2.2.

According to 1981 census the position in enumeration system was similar. Accordingly, the

adjusted workforce in the Livestock Sector was 4.98 million showing rise of 15.54 per cent in one decade.

The National Commission on Agriculture (NCA) in India observed that next to crops, animal husbandry has the largest employment potential in rural areas. Further, this sector can make a significant contribution to promoting redistribution effects on income in favour of weaker sections. This sector has large in-built potential for generating indirect employment in several ancillary activities like manufacture of livestock food, fabrication of dairy and poultry equipment and animal based industries concerning hides, skins, bones, wool, bristle, etc. The NCA has estimated that between 1972-2000 AD, this sector will have generated an additional direct employment of the order of 10 million per person - years. As part of an exercise to predict employment generation during 1978-83, we have estimated that during 1977-78 gross output of value of one million rupees at 1978-79 prices in this sector implied productive work of the order of 234 to 261 standard persons-years (of 273 days). This ranks among the top 8 sectors out of the 89 sectors into which the whole economy is divided in the context of exercises relating to generation of opportunities for gainful employment.

The economically weaker sections of the population prefer to supplement their income through livestock activities. This is high lighted in the

findings of a survey conducted by the NSSO during 1970-71 in rural India. Roughly half of the households reported possibilities of supplementing income and among them 92 per cent indicate livestock activities. Table 2.3 below presents the details

Table 2.3

Percentage of households reporting possibilities of supplementing income in different ancillary agricultural activities - rural India - 1970-71.

Activity	Percentage of Households	
	Small cultivator household	Non-cultivator wage earning households
Livestock	41.6(92%)	50.3(92%)
Dairying	24.8	28.6
Poultry	12.9	15.9
Other animal products	3.9	5.8
Other ancillary activities	3.4(8%)	4.3(8%)
Total	45.0	54.6

Source:- NSSO Report No.234 on the Dimensions of the Economic Problems of Weaker Section of Rural Population.

There are immense opportunities for the preparation of value-added products from animal biomass. It is thus obvious that well conceived farming systems based on animal husbandry programmes can make valuable contribution to achieving the triple goals of higher and more stable income, more opportunities for gainful employment and specific attention to the economic well-being of those living below the poverty line.

3. The need and scope for the conservation of animal genetic resources.

India is a vast sub-continent extending north-south between latitude 8° and 38° N and east-west between longitude 68° - 99° E. Consequently the country has regions lying in the tropical, sub-tropical and temperate zones. The agro-climatic variations range between extremes in respect of soils, temperature rainfall etc. Widely varying climatic zones occur, such as high altitude Himalayan regions, the Indo-gangetic plains, hot arid zones in western India, the Deccan Plateau in the South and the hot humid coastal areas. There are, therefore, a variety of plants combinations and livestock of different types and productivity and adaptability. Because of these widely varying agro-ecological conditions and the consequent different demand requirements of man from livestock such as work, food and clothing, the farmers of the country had developed over centuries by sheer intuition and experience, a number of superior types and breeds of domestic livestock, namely cattle, buffaloes, sheep and goats etc. The special regions of the country such as the alpine zones in Himalayas and the lower hilly areas of the north-eastern region have rare species of livestock such as yak and mithun which are used for transport and as source of food and fibre. These breeds and types of livestock which have been evolved within their ecosystem over several centuries have acquired adaptive characteristics including resistance to tropical diseases. They are also considered to be best suited to contribute to the economic benefits of the farmers in their respective home tracts.

The Indian sub-continent covers not only large areas with different agro-climatic zones but is known

for diversity of animal genetic resources with many important breeds of livestock specially draught, dual purpose and milk cattle, milk buffaloes, carpet wool sheep and prolific goat breeds. These breeds are adapted to tropical heat and diseases and poor quality feeds. There are 26 breeds of cattle⁷ of buffaloes, 40 of sheep, 20 of goats, 4 of camels, 6 of horses, 3 of pigs and 18 of poultry.

Due to lack of geographical barriers and little controlled breeding by government/breed societies, there has been large inter-mixing of breeds/types existing in contiguous areas for centuries resulting in dilution of breed characteristics making more than three fourth population non-descript. In the Five Year Plans breeders have taken recourse to introduction of exotic germ plasma into indigenous stock. Consequently animals with many different genetic combinations are progressively being produced. This can bring about rapid changes in the genetic structure of indigenous stock and lead to graded diminution and ultimate disappearance^{of} some of livestock which is well adapted to local situation. If this happens the future generations will be denied the fruits of thousand of years of natural evolution and human selection.

In the past no systematic efforts have been made to ensure collection and conservation of animal genetic resources. It is, however, being increasingly realised that the indigenous breeds especially draught and dual purpose breeds of cattle, carpet wool breeds of sheep and goats and species like yak, mithun and camel need to be evaluated, conserved and improved. This attempt

should be preceded by breed-wise study of their production, reproduction, adaptation and disease resistance characteristics especially in their home tracts and under existing management conditions. It may also be necessary to identify individuals, families, groups, types and breeds of specific genetic importance. The programme of work would broadly fall under two main functions, namely:-

- a) identification and classification based on ecological, genetic and economic criteria; and
- b) preservation.

The primary function will be identification and maintenance of superior herds or flocks of important available types/breeds for continuing use as breeding stocks both for pure breeding and cross-breeding. An identification and preservation of rare and/or vanishing breeds and types with valuable characteristics would help in their use in specific environments as well as in cross-breeding. The second function would be preservation of such stock either in small numbers with farmers or in assembled groups in organised farms. In India, the best preservation method would, no doubt, be the collection and breeding of such animals in designated flocks or herds rather than through preservation of semen. While it is comparatively easy to preserve plant genetic resources as frozen single cells or as seeds, in the case of livestock, it is apparent that preservation will have to take into consideration both the males and females. While there is good possibility of preserving the male germ plasm in frozen condition, similar attempt cannot be made in respect of female germ plasm. As sophisticated techniques are developed for isolation and preservation of zygote, the work will become easier. Even in freezing of semen while the present techniques, are

satisfactory for cattle and buffaloes, freezing techniques in respect of other species, like sheep, pigs, horses, camels etc. need more work on various aspects of the process. This is an important constraint which has to be taken note of in any programme of preservation of genetic resources. It is also stressed that maintenance of livestock herds in ecologically, geographically and utility conditioned situations appear to be the appropriate approach.

4. Setting up the National Bureau:

In the VII Five Year Plan, an important development in this direction in India is the setting up of a National Bureau of Animal Genetic Resources at Karnal (Haryana) by the Govt. of India (ICAR). The brief objectives of the Bureau are:-

To undertake systematic surveys for description, evaluation and cataloguing of livestock and poultry genetic resources and to establish a data bank and information service on these resources and to determine the need of and recommend steps for the conservation and management of these resources.

The Bureau's activities will initially be directed at collecting and collating the available published and unpublished information on breed descriptions. Simultaneously survey will be taken upto supplement on these breeds wherever full information is lacking. Along with the identification and description of a breed, information on topography, soil, water resources, physical environments, feed resources and management systems will be collected and compiled. Modern scientific tools especially the gene marker traits e.g. blood groups, biochemically polymorphic

traits and variations in chromosomal structure and number would be applied in establishing breed identity and studying their evolution. Studies relating to major histocompatibility complexes and DNA sequences have not been evolved to the extent of applying to description of and differentiation among breeds, but developments in these areas hold great promise for future.

The breeds of livestock have been evolved to meet specific requirements and have adapted well to their home tract environment and management systems. Information on environmental factors such as monthly average temperature and range, relative humidity, wind velocity, precipitation, day light hours, managements practices in vogue, feed resources, common health situation will give a meaningful description of any breed in the breeding tract. In addition it will also be necessary to give due consideration to interaction with man especially so with nomads, tribals and certain livestock raising communities who seem to have provided a type of isolation to their livestock ~~resulting~~ resulting in emergence of recognisable breed characteristic.

The Bureau will progressively undertake other tasks relevant to its activities and maintain liason with other national and international institution concerned with similar work. It will monitor the improvement programmes, including introduction of animal germ plasm and new synthetics etc. The Bureau will advise the Govt. and through cooperation with other agencies undertake conservation of indigenous resources

through both maintenance of purebreds on organised farms in their home tract and through cryogenic preservation of semen and fertilised embryos.

Registration in Herd Books is an important aspect for providing authoritative guidelines in breed standards. India took up Herd Registration Scheme quite early. Herd Books are being maintained for eight breeds of cattle viz. Sahiwal, Red Sindi, Tharparkar, Kankrej, Hariana, Gir, Ongole and Kangeyam and Murrah breed of buffaloes. Under this it has been possible to identify elite animals of various breeds. It will be desirable to make effective use of these Herd Books for genetic improvement and conservation of these breeds. Herd Book Registration could possibly then be extended to more important breeds of cattle, buffaloes and other livestock.

The newly set up National Research Centres by the ICAR on rare and economically important species - yak, mithun, equine and camel will help to supplement the activities of Bureau. Well established Institutes already exist for other species - cattle, buffaloes, sheep, fur animals goats and poultry. The Bureau should work in close collaboration with these Institutes/National Research Centres. It may also take up collaborative studies with the State Agricultural Universities. The National Institute of Animal Genetics a sister institute, located at the same campus will help to support the studies taken up by the Bureau. The Bureau will also develop Data Management System and have a proper storage and

retrieval system. Besides identification and collection of relevant data the Bureau will design data and information formats for easy storage and retrieval.

5. A Synoptic Survey of the animal genetic wealth of India.

a) Cattle:

In different parts of the country some well-developed breeds/types of cattle have been evolved over generations by the professional cattle breeders. The Royal Commission on Agriculture drew particular attention to the remarkable power of endurance of the Indian cattle and their resistance to tropical animal diseases, especially to the tick-borne protozoan infections.

There are 26 well defined breeds of cattle which constitute about 18 per cent of the total cattle population in the country. The breeds have been classified into milk, dual-purpose (milk and draught) and draught breeds. The milk yield of well defined breeds, bearing a few exceptions, is generally low per lactation. Under the successive five-year development plans the main emphasis has been on augmenting milk production in the country through a well defined breeding policy and country-wide development programmes. Breeding for milk production has been recommended in the milk-shed areas that could be conveniently linked to urban market centres. This is being attempted through cross-breeding of indigenous cows with exotic dairy breeds, mainly Jersey and Holstein-Friesian. Gradually cross-breeding has been extended to large areas in different parts of the country. However, the problem of its impact and possible adverse effects on production of quality draught animals for agriculture and other purposes arises

and has to be considered.

It is recognised that the role of cattle as main source of draught power for agriculture and allied operations continues to be equally important as for increased milk production. It is, therefore, necessary to improve the work efficiency of bullocks through improved breeding and feeding practices. It is also experienced that several parts of the country also do not offer favourable environments for production and maintenance of highly specialised dairy animals. In such areas improvement has to be brought about by selective breeding or grading up using improved breeds from other regions of the country having similar environmental conditions. Haryana, Tharparkar, Kankrej, Gir and Red Sindhi are breeds which show promise for selective breeding and grading up. Recognising the importance of indigenous breeds for draught power and the need for developing animal power on scientific lines the ICAR has initiated a much larger programme for Haryana and Ongole breed.

There are also a number of highly specialised draught breeds, like Nagori, Amritmahal, Hallikar and Kangyam whose breeding for production of draught bullock is a specialised economic enterprise with the cattle breeder in their respective breeding tracts.

b) Buffalo:

The domesticated water buffalo numbers at least 130 million, one ninth the number of cattle in the world. Between 1961 and 1981 the world's buffalo population increased by 11 per cent, keeping pace with the increase in cattle population. The domesticated buffaloes are classified into two main categories viz. the swamp buffalo and the river buffalo. They belong to the same species but have different habits. They interbreed and produce

fertile hybrid progeny. The swamp buffalo is more or less permanent denizen of marshy lands, where it wallows in mud and feeds in coarse marsh grass. It is found principally in parts of Assam and Tamil Nadu in India. The river buffaloes are found throughout India where clean water of rivers, canals and ponds ^{is} available to wallow. Out of the two general types - swamp and river buffaloes majority of animals in India belong to the latter type. These buffaloes are found from India to Egypt and Europe. They constitute around 65 per cent of the total world population of 130 million and account for 92 per cent of the total milk production. India alone contribute 43 per cent of the total milk produced by buffaloes. They are the dairy type water buffaloes. In India they play an important role in the rural economy as suppliers of milk and draft power. They comprise 35 per cent of India's milch animals (other than goats) but produce about 52 per cent of its milk. Buffalo butter fat is the major source of cooking oil (ghee) in India, Pakistan and in some other Asian countries.

Water buffalo is essentially a tropical animal. It is comfortable in hot, humid environments.

Well defined breeds with standard qualities are only found in India and Pakistan. There are 18 river buffaloes breeds in South Asia which are further classified into five major groups. The five groups and main breeds are:-

<u>Group</u>	<u>Breeds</u>
Murrah	Murrah, Nili/Ravi, Kundi
Gujarat	Surti, Mehsana, Jaffarabadi
Uttar Pradesh	Bhadavri, Tarai
Central India	Nagpuri, Pandharpuri, Parlakhemndi, Kalahandi, Sambalpur

South India

Toda, South Kanara.

The number of purebred animals is limited. Most of the buffaloes belong to a non-descript group called Desi.

High producing Indian breeds of buffaloes have been introduced in other countries like Malaysia, Indonesia, Philippines, Sri Lanka, Vietnam and Bulgaria. Breeds like Murrah, Nili/Ravi are popular in the country and abroad for their high milk production. The medium sized milch breeds like Surti and Mehsana are being increasingly used for upgrading non-descript buffaloes in some parts of the country. Other breeds have been developed as suited to the needs of the villagers. A typical example is the Bhadawri buffaloes in UP. The local people prefer buffaloes with high fat content milk. Bhadawri buffaloes yield about three to four kilograms of milk per day with a fat percentage that may go as high 13. Milk of these animals is, therefore, highly suited for ghee produce.

Emphasis in development of buffaloes in India has been mainly with consideration for milk production qualities. It appears necessary that these animals should, in addition to milk production, be also developed for meat qualities. Potential for developing market for buffalo meat within and outside the country are really large. A number of other countries are interested in using Indian breeds of buffaloes for developing their buffaloes for meat.

As India has several finest breeds of buffaloes, their conservation and development calls for urgent attention taking advantage of research information which has already become available on different genetic characteristics of this species. In this connection, a buffalo germ-plasm pool needs to be developed. The newly

set up Bureau of Animal Genetics Resources should take^{up} work as a clearing house of information and agency for exchange/supply of breeds material in the form of stock of frozen semen.

c) Sheep:

In India there are about 40 breeds/types of sheep found in different agro-climatic zones of the country. There are about 40 million sheep in India which ranks sixth among the countries of the world. There are wide variations in the types of sheep found in different agro-climatic zones. These are adapted well to local soil, feed and management conditions. Accordingly sheep raising tracts can be divided into 4 different regions, namely:-

- 1) the northern temperate region - sheep producing medium to fine wool,
- 2) the north-western dry region - sheep producing mostly coarse carpet type wool,
- 3) the southern peninsular region - sheep are primarily of meat type and a majority of them have coarse hairy and coloured fleeces, and
- 4) Eastern region - sheep having coarse coloured hairy fleece.

There is a large gap in the requirement and availability of wool for different sectors of woollen industry, namely woollen and worsted yarn in organised industry, carpet manufacture, Khadi and woollen manufacture. Accordingly, in the development plans, breeding programmes have been taken up envisaging cross-breeding with exotic wool breeds or dual purpose breeds, selective breeding among indigenous sheep and grading up of non-descript sheep with improved indigenous breeds.

Attempts to improve apparel wool production have been made in northern temperate region and a few pockets in the north-western region. Mostly Soviet Merino and Rambouillet are now involved in cross-breeding in these areas. In the Kashmir Valley, Merino type sheep have been developed - the so called Kashmir Merino. The other breeds in the northern region which have been identified as suitable for cross-breeding for finer wool are Chokla and Nali in Rajasthan, Haryana and Patanwadi area in Gujarat.

India produces carpet wool rated among best in the world. However, Indian carpet wool lacks luster and strength. Attempts to improve carpet wool sheep has been to improve quality by reducing medullation and increase quantity of fleece. Some of the good Indian carpet breeds are Magra, Jaisalmeri, Marwari, Pugal. In the Southern Peninsular region, there are some good quality mutton sheep like Nellore, Mandya etc. Among these selective breeding and cross-breeding with specialised exotic mutton breeds have shown promise. India has a large number of specialised breeds of sheep for production of carpet wool and mutton and there is scope for evolution of new breeds of sheep suited to tropical areas. The newly set up Bureau can undertake systematic work to identify and catalogue information which will be of use for preservation of indigenous types and development of newer varieties of sheep.

d) Avian Resources:

India is considered to be home land of the Red Jungle fowl. They are still abundant in some hill areas. The present day domestic fowl is believed to have descended from the Red Jungle fowl. Several other varieties of indigenous fowls are seen particularly

in tribal areas.

In the last more than two decades, a large population of exotic layers and broilers have been introduced in the country. Such introduction and large scale multiplication have gradually resulted in depletion of indigenous genetic types of poultry which are prized for their hardiness, disease resistance and adaptability to local agro-climatic environments. The indigenous birds are good breeders, forgers and efficient mothers, characteristic essential for raising poultry under village conditions. They are, however, poor producers. Their meat qualities are considered superior as local poultry meat is not only delicious but is also reported to have medicinal value in some breeds.

Among the indigenous birds, Aseel is a good example. This is known for its pugnacious qualities, high stamina, majestic gait, dogged fighting quality and mothering instincts. Only a few systematic studies on the economic merits of the indigenous birds have been made. Introduction on commercial scale of improved breeds from abroad have relegated desi birds to remote rural areas and small number of birds in pure form only seem to exist. Immediate steps for their conservation are necessary, a task which the new Bureau may include in their priorities. From among imported varieties, random bred control strains, inbred lines and high producing strains have been developed. The country is heading towards self sufficiency in production of quality chicks both for eggs and meat production. A separate Central Avian Research Institute

has been set up at Izatnagar in the Sixth Five Year Plan and several basic poultry breeding programmes are in progress and have started giving tangible results.

It is necessary to simultaneously make efforts to create a germ plasm pool of Indian poultry stock, native to the country and those recently evolved.

e) Yaks:

Yaks are important species of domestic animals kept in high altitude (4000-6000 m MSL) for transport, milk, hair and meat. Very little is known about these animals outside their habitat. In wild state it inhabits the coldest and most desolate tracts of Himalayas. In India these animals are found in Ladakh, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh. They are found generally along the snow line working up during summer and moving down during winter. Yaks can thrive on grasslands at high altitude where other species of livestock, except perhaps sheep, are unable to thrive. In these limited areas yaks play an important role in the economy of local people. They will continue to be valuable animals for local people in inhospitable, underdeveloped and difficult regions where other productive types of livestock are unable to thrive. Yaks are also used for cross-breeding local cows. Their crosses ^{are} called 'Choru' (male) and 'chaori' (female) in Himachal Pradesh. In different areas other names are used for the crosses. The cross-bred females produce more milk than female yak or local cow and are quite popular in these areas. The cross-bred are not only well adapted to high altitudes like yaks but they are better adapted than yaks to comparatively lower altitudes. The male cross-bred are infertile and, therefore, can only be used for work and meat.

There has been a marked decline in the population of yaks in India which may be attributed to the non-availability of alpine pastures during winter months due to closure of borders and disease incidence resulting from lack of veterinary cover.

Little authentic/scientific information is available about yaks due to scanty systematic studies undertaken earlier. Some ad-hoc studies taken up in sixties have not been comprehensive enough. There is, thus urgent need to preserve and multiply yaks and make systematic studies on their improvement and production of cross-bred progeny. The National Research Centre for Yaks and Mithuns recently set up by the ICAR is a step in right direction. This should be helpful for making in depth studies on these valuable animals as well as their conservation.

f) Mithun:

Mithun is a ruminant resembling domesticated beef cattle. They are found in hilly areas at altitude between 600-1500 m MSL and thrive well in these areas. Mostly they are confined to north-eastern hilly states of India and adjoining areas of Bhutan. Mithun are given away as bride price and are used as media of exchange due to lack of traditional currency. Mithuns are reared as a measure of status by people in the area.

Mithuns are usually kept under semi-wild conditions, mainly depending on various types of forest vegetation. They are used primarily for meat, though in Arunachal Pradesh, its crosses are also maintained as milch animals and for draught. Mithuns meat is considered as delicacy by tribal people.

Mithun population is declining over the years due to lack of attention to breeding, nutrition and health care. As Mithuns play an important role in the

economy of local people, all out efforts have to be made not only to check fall in their population, but efforts have to be made to systematically increase their number and improve their productivity. Survey on trends of mithun population, identification and classification of types and conservation deserve priority attention. ICAR has recently established a National Research Centre for Yaks and Mithuns to conserve and carry on research investigation on these species of animals. Such efforts should be supported by the Bureau of Animal Genetic Resources in the area of survey identification, classification and conservation of genetic resources of these animals.

6. Conclusion:

Genetic Resources constitute the most invaluable foundation for animal improvement. The productivity of an animal is the product of interaction between its innate genetic efficiency and the management efficiency of farmers. Animal Husbandry generates a considerable volume of downstream employment, because of its beneficial growth linkages.

In order to conserve the animal germplasm for current and future use, every country should have an integrated conservation strategy consisting of the following components:-

a) In situ conservation:

Biosphere Reserves, National parks, Wild Life Sanctuaries and Zoological Gardens.

b) Ex situ conservation:

Breeding herds - Pedigree bulls, Frozen Semen and Zygote banks, DNA Libraries.

Both populations and individual genotypes should be preserved.

An international System of Data base development is necessary for the exchange of information and data on a comparable basis.

Public awareness of the importance of conservation is essential for ensuring that valuable germplasm is not lost because of indiscriminate killing of animals for meat, skin, etc.

Animal Genetic Resources constitute a unique tool for rural development and agrarian prosperity. I hope this Congress will help to stimulate greater attention to this issue by professionals, political leaders and the public.

Acknowledgement:

I am extremely grateful to Shri A.C. Mathur for his valuable assistance in the preparation of this paper.

Table 2.1.

Gross value of output (At 1970-71 prices)
from agriculture and allied activities

(Rupees in crores)

Sector	1970-71	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85
Agriculture	17531	20424	21103	18549	20752	21757	21020	23457	23238
Livestock	3197	4083	4177	4259	4522	4611	4769	4935	5094
Hunting & Trapping	1	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Total Agriculture & Allied Sector	20729	24508	25282	22809	25275	26369	25791	28394	28333
Percentage Share of Livestock	15.42	16.66	16.52	18.67	17.89	17.49	18.49	17.38	17.98

Source:- National Accounts Statistics, January, 1987
 CSO, Deptt. of Statistics, Ministry of Planning

(1 crore = 10 million)

Table 2.2.

Industrial distribution of workers -
1961, 1971 and 1981.

Industry division	No. of workers (millions)		
	1961	1971*	1981
Agriculture & allied sectors other than livestock **	133.96	163.02	148.0
Livestock	3.94	4.31	4.98
Mining and Quarrying	0.96	1.05	1.28
Manufacturing & repair	18.65	21.35	25.14
Electricity, gas & water	0.66	0.56	0.89
Construction	2.15	2.43	3.72
Trade, restaurants & hotel	7.96	9.70	14.07
Transport, Storage & Communication Services.	3.14	4.60	6.12
Others (only in 1981)			18.22
Total:-	188.67	226.87	222.51

Source:- Census of India 1961 and adjusted figure for 1971 & 1981
(For 1981 data - Census of India - 1981, General
Economic Tables Part III A(1) Table B 3)

* - Census 1971 under-enumerated workers because of emphasis on main activity. As the concept of workers used in NSS 27th Round Survey (1972-73) was close to Census 1961 concept, participation rates derived from the Survey work applied to census 1971 population to obtain adjusted estimates. Industrial distribution has also been estimated.

** - Includes Fishing, forestry and logging and hunting and trapping sector.

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CHAPTER 2

KEYNOTE ADDRESS

by

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2.1 Introduction

I would like to compliment FAO and UNEP on this initiative in getting together some of the leading experts in the world in the area of animal genetic resources conservation. Interest in the conservation of plant genetic resources has tended to be more widespread thanks to the demonstration of the scientific and economic significance of such conservation by N. I. Vavilov about 60 years ago. Consequently, an International Board for Plant Genetic Resources is now functioning under the aegis of the Consultative Group on International Agricultural Research. The establishment of IBPGR has led to the identification of priorities and action programmes in the collection, conservation and evaluation of plant genetic wealth in a systematic, scientific and sustained manner.

In most of the developing countries, the livestock sector occupies an important place in the national economy. In countries like India, mixed farming involving crop-livestock integration has been a way of life since the beginnings of agriculture. Also it is now widely realized that this is the only method of providing additional income and employment to the small farmers and landless labour families. In fact, a great challenge before animal production experts in countries like India is the standardization of technologies which will help landless labour families to derive economic benefit from a land-based occupation like animal husbandry. Obviously this will call for high stability systems of stall-fed farm animal management. Socio-economic motivation becomes essential for generating the requisite political and public commitment to conservation particularly in poor nations where there are many competing demands for the limited resources available. While soil erosion attracts attention since it is visible to the eye, the erosion of valuable genes in animals and plants tends to get ignored until a disease epidemic, or some other production problem for which genetic solution is necessary, crops up.

Since my experience has been confined to the agricultural economy of India, I shall deal with the question of animal genetic resource conservation in the context of its socio-economic and scientific significance to India.

2.2 The Role of the Livestock Sector in Income and Employment Generation in India

The livestock sector is an important allied sector of crop production in the Indian economy. According to the National Accounts Statistics, the gross value of output from this sector at constant 1970-71 prices was equivalent to about 5 billion US\$ in 1977-78 and accounted for 16.3 percent of the total gross value of output from agriculture and allied sectors. The output from this sector recorded a steady rise during the eight years ending 1977-78, registering an overall growth of 24 percent at constant prices. Table 2.1 gives the trend during the eight years.

Table 2.1 Gross value of output (at 1970-71 prices) in India
1970-71 to 1977-78 in the agriculture and allied sectors

Sector	(Rs. in crores)							
	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78
Agriculture & Allied Sectors	20730	20800	19692	21051	20783	23093	22096	24412
Agriculture	17531	17549	16315	17619	17249	19292	18204	20441
Livestock	3197	3250	3375	3430	3533	3799	3891	3971
Hunting & trapping	1	1	1	1	1	1	1	1
Share of livestock (%)	15.42	15.62	17.14	16.30	16.99	16.45	17.61	16.26

Source: National Accounts Statistics, CSO
1 crore = 10 million

The share of livestock in the agriculture and allied sectors increased from 15.4 percent in 1970-71 to 16.3 percent in 1977-78 with the highest record of 17.6 percent in 1976-77.

The livestock sector provides gainful employment to a large work force. The 1961 Census which attempted a comprehensive coverage of workers enumerated 3.84 million workers in this sector constituting 2.04 percent of the total work force. The 1971 Census emphasized only the main activity in the enumeration of workers and thus yielded work force figures not comparable to the 1961 Census. Adjusting for this deficiency, the work force in this sector in 1971 is estimated at 4.31 million showing a rise of 12.2 percent in the decade. The distribution of work force by broad industrial divisions including livestock sector for 1961 and 1971 (adjusted) may be seen in Table 2.2.

Table 2.2 Industrial distribution of workers, 1961 and 1971

Industry division	No. of workers in millions	
	1961	1971*
Agriculture and allied sectors** other than livestock	133.96	163.02
Livestock	3.84	4.31
Mining and quarrying	0.96	1.05
Manufacturing and repair	18.65	21.35
Electricity, gas & water	0.66	0.56
Construction	2.15	2.43
Trade, restaurants & hotel	7.96	9.70
Transport, storage and communication	3.14	4.60
Services	17.35	19.88
<u>TOTAL</u>	<u>188.67</u>	<u>226.87</u>

Source: Census data for 1961 and adjusted census figures for 1971.

* Census 1971 under-enumerated workers because of emphasis on main activity. As the concept of workers used in NSS 27th Round Survey (1972-73) was close to Census 1961 concept, the participation rates derived from the Survey were applied to Census 1971 population to obtain adjusted estimates. Industrial distribution has also been estimated.

** Includes fishing, forestry and logging and hunting and trapping sectors.

According to the "Techno-economic Feasibility" report on Operation Flood II Dairy Project, the development of dairying activity would give productive employment to more women in rural areas. The report says that when Operation Flood II is fully implemented, year-round gainful employment will be made available to nearly 1.85 million people. The extent of labour intensiveness of dairying may be gauged from the assessment that while both the local cow and buffalo generate about 131 and 135 man-days of work per year, the crossbred cow and upgraded buffalo generate nearly 242 and 232 man-days of work per year, respectively. This underlines the need for appropriate genetic upgrading of the milk yield potential of local breeds.

The National Commission on Agriculture (NCA) in India observed that next to crops, animal husbandry has the largest employment potential in rural areas. Further, this sector can make significant contributions to promoting redistributive effects on income in favour of weaker sections. The sector has large in-built potential for generating indirect employment in several ancillary activities like manufacture of livestock feed, fabrication of dairy and poultry equipment and animal-based industries concerning hides, skins, bones, wool, bristle, etc. The N.C.A. has estimated that between 1972 and 2000 AD, the sector will have generated an additional direct employment of the order of 10 million person-years. As part of an exercise to predict employment generation during 1978-83, we have estimated that during 1977-78 gross output of value of one million rupees at 1978-79 prices in this sector implied productive work of the order of 234 to 261 standard person-years (of 273 days). This ranks among the top 8 sectors out of the 89 sectors into which the whole economy is divided in the context of exercises relating to the generation of opportunities for gainful employment.

The economically weaker sections of the population prefer to supplement their income through livestock activities. This is highlighted in the findings of a survey conducted by the NSSO during 1970-71 in rural India. Roughly half of the households reported possibilities of supplementing income and among them 92 percent indicated livestock activities. Table 2.3 presents the details:

Table 2.3 Percentage of households reporting possibilities of supplementing income in different ancillary agricultural activities - rural India, 1970-71

<u>Activity</u>	<u>Percentage of households</u>	
	<u>Small cultivator households</u>	<u>Non-cultivator wage-earner households</u>
<u>Livestock</u>	41.6 (92%)	50.3 (92%)
Dairying	24.8	28.6
Poultry	12.9	15.9
Other animal production	3.9	5.8
<u>Other ancillary activities</u>	3.4 (8%)	4.3 (8%)
TOTAL	45.0	54.6

Source: NSSO Report No. 234 on the Dimensions of the Economic Problems of Weaker Section of Rural Population.

It is thus obvious that well-conceived farming systems based on animal husbandry programmes can make valuable contributions to achieving the triple goals of higher and more stable income, more opportunities for gainful employment and specific attention to the economic well-being of those living below the poverty line.

2.3 The need and scope for the conservation of animal genetic resources

India is a vast sub-continent extending north-south between latitudes 8° and 38° N and east-west between longitudes 68° - 99° E. Consequently the country has regions lying in the tropical, sub-tropical and temperate zones. The agro-climatic variations range between extremes in respect of soils, temperature, rainfall, etc. Widely varying climatic zones occur, such as the high altitude Himalayan regions, the Indo-gangetic plains, hot arid zones in Western India, the Deccan Plateau in the south and the hot humid coastal areas. There are, therefore, a variety of plants combinations and livestock of different types and productivity and adaptability. Because of these widely varying agro-ecological conditions and the consequent different demand requirements of man from livestock such as work, food and clothing, the farmers of the country had developed over centuries by sheer intuition and experience, a number of superior types and breeds of domesticated livestock, namely cattle, buffaloes, sheep, goats, etc. The special regions of the country such as the alpine zones in the Himalayas and the lower hilly areas of the north-eastern region have rare species of livestock such as the yak and mithun which are used as beasts of burden and as sources of food and fibre. These breeds and types of livestock have considerable adaptability to local climatic environments and stress of food and fodder constraints and have acquired considerable resistance to tropical diseases. They are also considered to be best suited to contribute to the economic benefits of the farmers in their respective home tracts.

Under the five-year development plans, efforts have been continuously made to improve the type and productivity of different breeds of livestock and poultry. In view of the necessity of effecting rapid improvement in the productive capacity of cattle and buffaloes for milk, poultry for eggs and sheep for wool etc., breeders have taken recourse to the introduction of exotic germ plasm into the indigenous stock. The breeding systems adopted for various species include selection and crossbreeding among indigenous breeds and direct introduction of exotic breeds and crossing of exotic and local breeds. Consequently, livestock with many different genetic combinations are progressively being produced. Such rapid changes in the genetic structure of the indigenous livestock population could lead to a gradual diminution and even ultimate disappearance of some of the adopted livestock. If this happens, future generations will be denied the fruits of thousands of years of natural and human selection. No systematic efforts had been made in the past to ensure collection and conservation of animal genetic resources. This has assumed all the greater urgency in recent years, due to large nationally and internationally supported animal breeding projects initiated in many developing countries.

The task of conservation of livestock is obviously a more complex problem than conserving plant genetic types. The breeds and the different genetic types of indigenous livestock are found scattered over different geographic locations varying in agro-ecological and socio-cultural conditions. These are also maintained either in organized farms or as a component of mixed farming system by different categories of farming communities. The groups of these animal types also undergo continuous change in the genetic structure through natural selection or as a result of planned breeding programmes. It may also be necessary to identify individuals, families, groups, types and breeds of specific genetic importance. The programme of work would broadly fall under two main functions, namely:

1. identification and classification based on ecological, genetic and economic criteria,
- and
2. preservation.

The identification and maintenance of superior herds of flocks of important available

types or breeds for continuing use as breeding stocks, both for purebreeding and in crossbreeding would be the primary function. An identification and preservation of rare and/or vanishing breeds and types with valuable characteristics would help in their use in specific environments as well as in crossbreeding. The second function would be the preservation of such stock either in small numbers with the farmers or in assembled groups in organized farms. So far as India is concerned, the best preservation method would, no doubt, be the collection and breeding of such animals in designated flocks or herds rather than through the preservation of semen. While it is comparatively easy to preserve plant genetic resources as frozen single cells or as seeds, in the case of livestock it is apparent that preservation will have to take into consideration both the males and females. Cytoplasmic effects may be important with regard to some traits. While there is good possibility of preserving the male germ plasm in frozen condition, similar attempts cannot be made in respect of female germ plasm. As sophisticated techniques are developed for isolation and preservation of zygotes, the work will become easier. Even in freezing of semen, the present technology seems to be satisfactory only in respect of cattle and buffaloes. Semen freezing techniques in respect of other species - sheep, pigs, horses, camels, etc. have not yet been satisfactorily developed. This is an important constraint which has to be taken not of in any programme of preservation of animal genetic resources. It is also stressed that maintenance of livestock herds in ecologically, geographically and utility conditioned situations appears to be the appropriate approach.

An important function of any conservation organization (e.g. a national bureau) would be the cataloguing of information and exchange of breeding material. It would be necessary to formulate criteria and parameters in respect of quantitative and qualitative characteristics in order to enable the identification of individual herds and flocks of superior genetic stock. This should be followed by documentation of the required information in regard to identity of herds. Such information will have to be processed through punch card system and computer analysis. The national bureau naturally will have to maintain national and international liaison with institutions connected with similar work. The bureau would be basically the centre for information on available information, regarding the genetic resources of superior types/breeds of animals in the country. As regards the exchange of material, it has to be mainly in the form of exchange of breeding animals particularly on the female side and frozen semen. A National Bureau of Animal Genetic Resources on these lines is being set up in India by the Indian Council of Agricultural Research (see Bhat, Chapter 8).

2.4 A synoptic survey of the animal genetic wealth of India

(a) Cattle: Some well-developed breeds/types of cattle have been evolved over generations by the professional cattle breeders in different parts of the country. The Royal Commission on Agriculture drew particular attention to the remarkable powers of endurance of the Indian cattle and their resistance to tropical animal diseases, especially the tick-borne protozoan infections.

There are about 27 breeds of cattle which have been recognized and classified into milk, dual-purpose and draught types. Under the successive five-year development plans increasing emphasis is being laid on augmenting milk production in the country to narrow the gap between the availability and demand for milk. Breeding for milk production has been recommended in the milk-shed areas that could be conveniently linked to urban market centres. This is being attempted through planned crossbreeding of local cattle with exotic dairy breeds. As crossbreeding programmes are progressively extended to cover more and more areas the problem of its impact and possible adverse effects on production of quality draught animals for agriculture and other purposes arises and has to be solved.

The role of cattle as the main source of motive power for agriculture and certain allied operations would continue to be almost as important as meeting the requirements of milk in the country. There is need also to improve the work efficiency of bullocks through improved breeding and feeding practices. Several parts of the country also do not offer favourable environments for production of highly specialized dairy animals. In such areas improvement of cattle has to be brought about either by selective breeding or through grading-up using improved breeds from other regions of the country having similar environmental conditions. Zebu cattle are considered as the most productive types found in the tropics. Breeds that show promise for selective breeding or grading-up are Haryana,

Tharparkar, Kankrej, Gir and Sindhi. Herds of selected good specimens of these breeds are being developed where breed improvement is attempted through farm-level progeny-testing systems.

Recently, in the search for improved indigenous milch types of cattle the Rathi breed of Rajasthan has been identified. These animals have the hardiness to thrive under adverse conditions and are yet capable of economic levels of milk production. Attempts have been made to collect good specimens of Rathi animals and maintain and breed them in herds under better conditions in the private and public sectors.

There are also a number of highly specialized draught breeds, like Nagori, Amritmahal, Hallikar and Deoni whose breeding for production of draught bullocks is a specialized economic enterprise with the cattle breeders in their respective breeding tracts.

Zebu cattle of India are in great demand in countries like Brazil for development of beef breeds. Some attempts have been made to identify and catalogue information on some of the indigenous breeds through Herd Book Projects. These attempts should be properly organized and supplemented through a bureau for preservation and promotion of these breeds not only for local use but also for promotion of export either in the form of livestock or frozen semen from selected superior bulls.

(b) Buffalo: In all countries where domesticated buffaloes are found, they are valued as triple purpose animals for milk, work and meat. In spite of the fact that the contribution of the buffalo to the agrarian economy is quite substantial, this species had remained neglected till the recent past.

The buffaloes in India are mostly of the Riverine type, though in southern India they have the Swamp as well as River characteristics. High producing Indian breeds of buffaloes have been introduced in other countries like Malaysia, Indonesia, Philippines, Sri Lanka, Viet Nam and Bulgaria. Though the I.C.A.R. has described characteristics of several breeds, there are a number of other breed/types in the different parts of the country. Breeds like Murrah, Nili/Ravi are popular in the country and abroad for their high milk production. There are some medium-size milch breeds like Surti and Mehsana which are increasingly used for up-grading nondescript buffaloes in some parts of the country. Other breeds have been developed as suited to the needs of villagers. A typical example is the Bhadawari buffaloes in U.P. The local people prefer buffaloes of black colour and milk yield with high fat content. Bhadawari buffaloes yield about three to four kilograms per day with a fat percentage that may go up to as high as 13. Their milk is, therefore, highly suited for ghee making as the common village practice is to sell ghee to supplement income. It is also believed that males of this breed can stand heat better and can be used for draught.

Buffaloes in India have been mainly evolved with consideration of milk production characteristics. It appears necessary to develop the buffalo not only for milk production but also for production of quality meat as the potentialities for developing a market for buffalo meat both within the country and abroad are really large. A number of other countries are interested in using Indian breeds of buffalo for developing their buffaloes for meat.

There is already increasing demand for buffaloes from India from many countries. A buffalo germ-plasm pool and a bureau as a clearance house of information and agency for exchange/supply of breeds material in the form of stock of frozen semen are becoming increasingly necessary.

(c) Sheep: In India there are about 40 million sheep and India ranks sixth among the countries of the world in sheep population. There is a wide variation in the types of sheep found in the different parts of the country. Based on agro-climatic conditions and the types of sheep found in different zones, sheep raising tracts in India can be divided into three district regions, namely:

- (1) the northern temperate region where sheep produce medium to fine wool

- (2) the north-western dry region with sheep producing mostly coarse carpet quality wool, and
- (3) the southern peninsular region where sheep are primarily of meat type and a majority of them carry coarse hairy and coloured fleeces.

In view of the large gap existing between the requirements and availability of wool for the different sectors of the woollen industry, namely, carpet manufacture, woollen and worsted yarn in organized industry, Khadi and woollen manufacture, and the cottage industry, breeding programmes have been taken up envisaging crossbreeding with exotic wool breeds or dual-purpose breeds, selective breeding among indigenous sheep and grading-up of nondescript sheep with improved indigenous breeds.

In the Kashmir valley, Merino type sheep have been developed - the so-called Kashmir Merinoes. In the northern region, there are breeds such as Chokla and Nali in Rajasthan and Patanwadi in Gujarat which have been identified as suitable for crossbreeding for production of wool of Merino level.

India produces carpet wool rated among the best in the world but still Indian carpet wools lack lustre and strength. The approach for carpet-wool sheep improvement has, therefore, a two-pronged objective, namely, to improve quality and to increase quantity of the fleeces. Some of the good Indian carpet breeds are Marwari, Jesselmeri, Pugal and Magra and breeds of sheep in Gujarat other than Patanwadi. In the southern peninsular region, there are some good-quality mutton-type sheep, like the Mandya, Nellore, Madras Red, etc. Selective breeding among these breeds and crossbreeding of these sheep with exotic mutton breeds have shown promise. In view of the existence of a large number of specialized indigenous breeds best suited for carpet wool and mutton production and evolution of new breeds of sheep suited to the tropical areas with capacity for improved wool and mutton production, there is need for an organization, which could identify and catalogue information which will be of use for preservation of the indigenous types and development of newer varieties of sheep.

(d) Avian Resources: India is considered to be the homeland of the red jungle fowl from which all poultry stocks have been evolved. The red jungle fowls are still abundant in some hill areas. Several other varieties of indigenous fowls are seen, particularly in tribal areas.

The introduction and large-scale multiplication of breeds of chicken from developed countries have gradually resulted in the depletion of indigenous genetic types of poultry which are prized for their hardiness and resistance to diseases, flavour of meat, etc. which are lacking in the present-day elite high productive breeds. Indigenous or desi poultry are well known for their adaptability to local agro-climatic environments, though of lower productivity. They are good breeders, foragers and efficient mothers, characteristics essential for raising of poultry under village conditions. The meat qualities are considered superior as local poultry meat is not only delicious but also considered to be of medicinal value in some breeds.

A good example of desi chicken is the Aseel noted for its pugnacious qualities, high stamina, majestic gait, dogged fighting qualities, meat quality and mothering instincts. Systematic studies on the economic merits of indigenous breeds of chicken are scanty. In recent years, use of improved breeds from abroad has relegated desi birds to remote rural areas. From among imported varieties, random-bred control strains, inbred lines and high production strains have been developed. The country is also heading towards self-sufficiency in production of quality chicks both for egg production and poultry meat. Basic poultry breeding programmes are in progress and have started giving tangible results.

The time has come to take simultaneous efforts to creating a germ-plasm pool of Indian poultry stocks, native to the country and those recently evolved.

(e) Yak: Yaks are an important species of domesticated animals kept in high altitudes for transport, milk, hair and meat. Very little is known about these animals outside their habitat. In India yaks are found in Ladakh, Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh. Yaks are generally found along the snowline moving up during summer and moving down during winter. Yaks can thrive on grasslands at high altitudes where other species of livestock, except perhaps sheep, are unable to thrive. In these limited areas where yaks are still found they play an important role in the economy of local people. In some places yaks are considered indispensable. Yaks will continue to be valuable animals for local people in inhospitable, underdeveloped and difficult regions where other productive type of livestock are unable to thrive. Yaks are also maintained for crossing with cattle as the crossbreds are not only well adapted to high altitudes like the yaks but they are better adapted than yaks to lower altitudes. The females of such crosses are fertile and yield more milk than the yak female. The male crossbreds are infertile and therefore can only be used for work and meat.

There has been a progressive and marked decline in the numbers of yaks in India which may be attributed to the non-availability of alpine pastures during winter months due to the closure of borders and incidence of diseases due to lack of adequate veterinary cover. There is a need to preserve and multiply yaks and make systematic studies on improvement of the species and production of crossbred progeny.

(f) Mithun: The mithun is a ruminant resembling domesticated beef cattle. Mithuns are sure-footed animals and can thrive well in hilly terrain. They are confined to the north-eastern hilly states of India. It is estimated that there are about 95,000 mithuns in Arunachal Pradesh, 17,000 in Nagaland, 8,500 in Manipur, and 500 in Mizoram. The mithun has an important place in the economy and social life of tribal population in these areas. They are given as bride price and are used as media of exchange due to lack of traditional currency; they are also used as a measure of the status of the person in the community.

Mithuns are usually kept under semi-wild condition, mainly depending on various types of forest vegetation. The mithuns are poor milk yielders but the meat of mithuns is considered a delicacy by the tribal people. They are used for crossing to cattle to produce crossbreds for milk production and draught purposes.

It has been observed that mithun population is declining over the years due to lack of attention to breeding, nutrition and disease control. In view of the important place of mithuns in the rural economy in the tribal areas the declining number has to be checked and the trend reversed. Survey on trends of population, identification and classification of types and conservation of mithuns deserve priority attention. A project has been recently taken up by the ICAR for the establishment of a National Research Centre for yaks and mithuns to conserve and carry on research investigations on these two species of animals. Such efforts should be supported by the Bureau of Animal Genetic Resources in the area of survey, classification and conservation.

2.5 Conclusions

Conservation is an area where scientific efforts will have to be supported by social and political consciousness and action. An outstanding example of the power of such a synthesis is seen in what happened at Leningrad during World War II. The Vavilov All-Union Institute of Plant Industry which has a very rich collection of germ-plasm of wheat, potato, etc. continued to grow the collection during the war. These were apparently the only crops growing in the area. Leningrad's besieged citizens were suffering from acute hunger. A large number died due to starvation. But it is to their great credit that none stole grain or potatoes from the fields or gene bank of the Vavilov Institute of Plant Industry. This is the richest tribute that could be rendered to the life and work of Vavilov and to the spirit of conservation. It is this kind of social commitment to the conservation of genetic resources that scientists should help to generate. The World Conservation Strategy launched this year under the overall leadership of the International Union for Conservation of Nature lays great stress on the preservation of genetic variability in all living organisms. Without people's involvement, this will not be