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Conservation of livestock breeds for sustainable live stock production

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Abstract

India possesses rich livestock genetic diversity, with numerous indigenous breeds adapted to diverse agro-ecological conditions. These breeds possess valuable traits such as heat tolerance, disease resistance, adaptability to harsh environments, and efficient production under low-input systems. However, indiscriminate crossbreeding, mechanization, changing production systems, climate change, and socio-economic factors are causing genetic erosion and threatening several indigenous breeds. Conservation of livestock genetic resources is therefore essential for sustainable livestock production and future breeding programmes. Both in situ conservation through maintenance of live populations and ex situ conservation through cryopreservation of semen, oocytes, embryos, and other genetic material are important. Effective conservation requires breed characterization, scientific breeding programmes, farmer participation, breeder organizations, genetic databases, reproductive technologies, and public awareness. Integrated conservation and sustainable utilization of indigenous breeds can help preserve valuable genetic resources while improving livestock productivity and resilience.

Keywords: Livestock genetic resources, indigenous breeds, conservation, in situ conservation

Introduction

India is the seventh largest country in the world and it is recognized as one of the 12 mega bio diversity centers of the world. Due to diverse agro – ecological regions and topographic conditions, India has vast repository of domestic animal biodiversity with a large number of breeds of all live stock and poultry. The diversity of domesticated live stock breeds was developed due to years of evolution adopted to specific ecological niche and local needs. There are thirty seven recognized breeds of cattle in India, in addition to large number of non – descript cattle. The share of India in terms of number of breeds is 7.75 percent of the total world cattle breeds.

India hosts 37 cattle breeds of which Tamil Nadu has four recognized breeds named as Burgur, Kangayam, Umblachery and Pulikulam. Of the the 13 Indian Buffalo breeds, Tamil Nadu has one named as Toda buffalo. Tamil Nadu is the native of 8 sheep breeds named as Mecheri, Madras red, Ramnad white, Nilgiri, Coimbatore, trichy black, Vembur and Keezhakaraisal and 3 goat breeds named as Kanni aadu, Kodi aadu and Salem black among 23 and 39 sheep and goat breeds of India respectively. Each breed should be regarded as collection of special genes designated to serve specific purposes in particular agro – ecological zones and a valuable genetic resource. The livestock is being endowed with unique qualities like tolerance to high heat and humidity, resistance to diseases and ability to survive under severe nutritional stress. According to FAO recent statistics, 22 percent of the world's more than 8000 livestock breeds are classified as at risk of extinction.

A number of these breeds are subjected to fast genetic degradation and dilution because of indiscriminate breeding and introduction of exotic germplasm. Since last two decades the emphasis on draft ability of cattle has reduced due to mechanization of agriculture and transport. Cross breeding of native cattle for increased milk production has been advocated as a breeding policy across the country. As a result, some indigenous breeds are getting endangered at an alarming rate while others are in the process of replacement by certain high

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producing strains. The need for parallel conservation of animal genetic resources as a raw material for future animal breeding programmes is also recognized as is becoming an important issue in international, national and regional Animal Husbandry Planning. Conservation of livestock is of particular concern in regions where rapid agricultural change takes place, where indigenous stocks and farming methods are replaced by climatic change and disease. Different reasons for conservation of animal genetic resources include.

1. Economic and biological reasons

Genetic variation both within and between breeds is the raw material with which the animal breeder works. Therefore, any loss of genetic variation will limit our capacity to respond to changes in economic forces for the exploitation of animal production in future. Breeds with specific qualities like resistance, heat tolerance, ability to survive and produce under stress and low input conditions need to be preserved for future use. Future requirements of type and quality of animal produce (milk, draught power) may change and this requires conservation of animals better performance in specific production traits. Magnitude of heterosis depends upon the breeds crossed. For exploiting the heterosis in animal production it is necessary to maintain breeds which are complementary to each other and on crossing result in maximum heterosis.

2. Scientific reasons

Breeds with unique physiological (or) other traits are of great value as they provide missing links in the genetic history of a livestock species by the study of blood groups on polymorphic traits. To identify the DNA sequences causing the distinctive traits, preservation of breeds with unique traits will be essential for long term research in molecular engineering. To evaluate the magnitude of genetic change due to selection maintenance of a sample as control population is very much essential.

3. Historical and cultural reasons

Conservation of historically important, culturally interesting and visually unusual and attractive population is very important for education tourism etc. serve as research and teaching material in history and ethnography. Conservation of breeds will be preservation of population with diverse sizes colours and other morphological features for aesthetic reasons etc.

Identifying reasons for the loss of animal genetic diversity

There are several factors that place breeds at risk of extinction and threaten livestock diversity (FAO, 2007b; FAO, 2009b) ^[5, 6]. In developed countries, the greatest cause of genetic erosion is, by far, the growing trend towards a global reliance on a very limited number of international transboundary breeds suited to the needs of high input – high output industrial agriculture. The effect of this trend is that many breeds have fallen out of use and disappeared without notice. In developing countries, genetic diversity is potentially threatened by a variety of influences. In the literature, there is broad agreement regarding the general trends and factors threatening animal genetic resources in developing countries, viz.

1. Change in production system
2. Producer preference – consumer demand - lean pork
3. Socio economic factors
4. Natural disasters (drought, famine, disease, epidemics and war)
5. Development of technology (Biotechnology)
6. Lack of sustained breeding programme

7. Increased demand for livestock products
8. Climate change
9. Loss of labour force
10. Migration of livestock keepers to urban area

Conservation Strategies

(A) Breeding Policy

The States may review their respective breeding policy so as to prioritize conservation of Indigenous breeds in their breeding tract and allowing no cross breeding of recognized indigenous cattle in the home tract of important and recognized indigenous breeds.

(B) Implementation of the Breeding Programme

1. The State may consider region specific and breed specific breeding strategies, programmes and plans to implement the conservation programme.
2. The States may delineate and identify, in their respective breeding policies, the geographical boundaries of the areas where non-descript cattle should be upgraded by crossing with bulls of indigenous breeds. Once such areas are earmarked, no cross-breeding of non-descript cattle, other than with bulls of indigenous breeds, should be permitted.
3. The areas for cross-breeding of non descript cattle with exotic breed may be identified.

(C) Promotion of Breeders organization

1. Breeding Farms

The existing States breeding farms of indigenous breeds should be declared as germplasm repositories and used for production of bulls. Only pure breeding should be practiced at these farms.

2. Gaushala

Conservation efforts have mostly limited to institutional farms with small herd sizes, leaving larger parts of the breeding tract totally neglected. There are large number of Gaushala have quite sizable populations of purebred animal of Indigenous breeds but do not have the resources for maintaining and improving these animals. Such Gaushala may be supported to maintain indigenous breeds so that they can supply improved quality of germplasm for breeding. They should be provided with scientific and technical inputs and training for genetic evaluation.

(D) Role of voluntary organization

1. Breeder Association – without involvement and participation of farmer's it is not possible to conserve the breed. Improvement of Indigenous breeds can be taken up in collaboration with Breeders' association through selection of outstanding animals true to their breed types.
2. These Breeders' association can be encouraged to form a Federation at the State/District level to take up issues relating to conservation and development of respective indigenous breeds. States may consider having State level awards for Breeders' associations and for progressive farmers who have contributed to conservation and development of recognized indigenous breeds.

(E) Use of Science and Technology

Since the introduction of cross breeding programme, most of the techniques and methodologies for breed improvement have been used to produce cross bred cattle. The application of such technologies for propagation and improvement of indigenous breeds is a relatively rare phenomenon, one of the reasons for which may be the reluctance of the farmers, owning these breeds to accept new and established techniques

for reproduction.

1. Technologies such as artificial insemination, Frozen semen production, progeny testing, embryo transfer technology should be used, after proper evaluation where ever required.
2. National gene bank should maintain the germplasm in the form of semen & embryo. Regional gene banks should meet the requirements of National gene bank.

(F) Data Base

1. A reliable data base should be developed with regard to all the details of Indigenous breeds, including their breeding tracts, numbers, characterization, gene make up, the institutional farm where they are being preserved and / conserved.
2. The national level data base for cattle and buffalo developed by NDDDB may be utilized for this purpose.
3. A breeding network should be set up by computerizing and net working all AI outlets, semen stations, breeding farm and Gaushala.

(G) Creation of Public Awareness

1. Available information on different breeds should be published in the form of pamphlets, books, calendar etc. This will create awareness and motivate farmers to conserve the important breeds.
2. Some farmers are the proud owner of the popular breeds of their area. Such farmers, if encouraged through financial & veterinary help will help in preservation of breeds
3. Breeds shows should be arranged for local breeds and owners should be rewarded for maintaining pure local breeds. Publish success stories on local breed conservation and innovative utilization.

Mechanism of conserving cattle genetic resources

Once genetic resources have been identified and characterized, two basic conservation activities can be followed, i.e., in situ and ex situ.

In situ conservation

In situ conservation requires establishment of live animal breeding farms and their maintenance. The generation and loss of alleles is a dynamic process that should be maintained at close equilibrium through sound management. In situ conservation strategies emphasize wise use of indigenous cattle genetic resources by establishing and implementing breeding goals and strategies for animal sustainable production systems. In India, such efforts are limited to only six breeds of cattle, in a herd registration program organized by the Central Animal Husbandry Department (Balaine *et al.*, 1987) [3]. Similar programs are required for the rest of the breeds and species as well. In any such program, the success depends upon the participation of the farmer for which he needs support and incentive. Therefore, it is difficult to organize the farmers for conserving the breeds which are no more economical to him. In the case of breeds which are no more economically viable, therefore, the only alternative is to bring them under government farms. In situ conservation is very costly if the entire population has to be retained for which at least 26 females and 10 males in cattle have to be maintained that would keep the inbreeding coefficient at 0.2 per cent per year (Smith, 1984). Therefore, this approach would have to be limited to those breeds which are highly endangered. Modalities for simplified animal recording, genetic development and dissemination are needed for each species for a range of national livestock structures in developing countries.

Major advantages of in-situ conservation:

1. Live animals can be evaluated and improved over the years.
2. Genetic defects can be detected and eliminated.
3. Live animals are always available for immediate use.
4. They are a gene bank for future use.
5. They are a constant reminder that the needs of posterity must be considered.
6. The herd may have some economic advantages (heat tolerance, disease resistance) which can be exploited and so render the enterprise economically viable.
7. The produce from live animals partly compensates the expenditure, if not entirely.
8. From aesthetic point of view, the live animals are, visible, a pleasure to look at, the people are delighted to see variety of animals and have some cultural value.

The major limitation of live animal conservation is the number of animals that could be maintained. While fixing the number for preservation of a breed, the cost of maintenance, availability of animals and rate of inbreeding should be taken into consideration. With small population size, the effective population size decreases and the genetic structure of the population is affected due to inbreeding and random drift. Many models are now available which reduce inbreeding to a minimum, but random drift over long periods may lead to a population very different in genetic composition from the initial one. In situ conservation involves a large infrastructure of land, buildings, feed and fodder resources, water supply, labour, technical and supervisory man-power, etc. Therefore, new establishments for in-situ conservation of farm cattle genetic resources are quite costly and even the maintenance of existing ones is cumbersome. The costs need to be estimated for each ecosystem. Smith (1984) recommended that the population size should be such that increase in inbreeding should not be more than 0.2% per annum for preserving the breed in situ. Turner (1987) recommended a flock/herd of 150 breeding females with 20 breeding males, the males being unrelated as far as possible, for preservation purposes. Brem (1990) [4] considered a maximum inbreeding level of 1% per generation as tolerable. He suggested that a herd size of 200 breeding animals is necessary to breed and selected successfully for a quantitative trait. Henson (1990) [8] observed that an effective number of 25 animals per generation will be able to preserve about 50 per cent of genetic diversity in a breed over 50 generations, while an effective number of 50 per generation will maintain 75 per cent of the diversity. To maintain 100 per cent genetic diversity an effective number of 500 animals per generation will be needed. Majjala (1990) [10] reported that heterozygosity starts declining at an accelerating rate after the effective population size falls below 100, while the genetic drift increases rapidly when the effective size is less than 30. In case of preservation of small populations, to prevent undesirable effects of inbreeding and random drift, FAO suggested a mating ratio of 5 males and 25 females, but a ratio of 50- males and 250 females is recommended in case of traits with low heritability (Anon., 1987) [2]. When preservation is through cryogenic methods, semen from 25 unrelated males should be frozen and embryos from 35 different matings must be ensured for embryo freezing.

Ex-situ conservation

Ex-situ conservation includes cryogenic preservation. It is the storage of genetic resources, which the farmers are currently not interested in using. Ex situ conservation is based on the use of live animals populations wherever practicable,

supported by cryopreservation where technology exists or can be developed, combining within-country gene banks with global repositories. Interested governments, non-governmental organizations, research institutions and private enterprises should be encouraged to maintain *in vivo* samples of breeds at risk, with national inventories being established and kept up to date so that the genetic resources are readily available for use and study. *Ex situ* conservation is comparatively more convenient, economical and easy with the application of modern reproductive technologies.

Advantages

1. If the preservation is to maintain populations without genetic change, it can be best done by cryogenic storage as it is difficult to breed many generations of animals without any change in the genetic structure.
2. The resources requirement for *in situ* preservation is quite large as compared to cryogenic methods.

Limitations

1. *Ex situ* preservation using frozen semen delays the restoration of a breed as it can be restored in the future only by upgrading. But this could be overcome through preservation of embryos.
2. Another important factor is the danger faced by a breed restored from cryogenic preservation from important changes in the environment like germs, climate, etc., that have taken place over the years.
3. Variability in cryogenic storage of germplasm, accessibility to their physical location, ownership, behaviour of animal, response of germplasm to freezing and thawing techniques, and poor conception rate.

Ex situ/Cryogenic preservation includes

1. Preservation of frozen semen
2. Preservation of oocytes
3. Preservation of embryos
4. Preservation of ovaries
5. Use of embryonic stem cells or blastomeres
6. Production of chimeras
7. Production of embryos *in vitro*
8. Embryo splitting
9. Transgenesis
10. DNA libraries (Polge, 1990) ^[12].

1. Semen preservation

Semen cryopreservation and artificial insemination are important tools of animal improvement with vast scope of genetic improvement, conserving indigenous cattle resources because of their simplicity and relatively cheaper costs. Semen storage and distribution activities are being carried out in a few well-known indigenous milch cattle. Still, many breeds like Amrithmahal, Dangi, Gaolao, and Punganur lack such facilities. Spermatozoa may also be collected from the epididymis.

2. Oocyte preservation

This method provides an opportunity for conserving females in the same way as sperm is conserved. The oocyte can be recovered by surgery, laparotomy or slaughtering of donor animals. The frozen thawed oocyte can be used for IVF successfully (Schellander *et al*, 1988) ^[13]. The immature and mature oocyte from slaughtered animals could be useful in near future for cryopreservation of genetic material of endangered breeds.

3. Embryo preservation

The main advantage of cryopreservation of embryo over that of sperm or oocyte is that it contains the complete genome. The embryo transfer technique coupled with micro manipulation, embryo sexing and splitting are more useful and economical to carry out *ex situ* conservation of animal genetic resources. This technique is very useful in

conservation of genetic resources by rapid multiplication of superior or rare germplasm. MOET can be used in resurrecting the endangered cattle breeds like Sahiwal, Punganur and Vechur.

4. Preserving of ovaries

The preservation of slices of ovaries in liquid nitrogen is a new technology which may be of great use in conservation of animal genetic resources. The ovary slices might be transferable into suitable recipients to obtain oocytes which can be fertilized.

5. Embryonic stem cell and nuclei

Preservation of embryonic stem cells could represent an important method of genome conservation and would be helpful in propagating animals from a single embryo of elite or rare animals belonging to endangered breed/species. Embryonic stem cells represent progressively growing cultures of embryonic cells which retain their pluripotential characteristics. They are derived by culturing blastocysts *in vitro* in such a way that the cells from the inner cell mass proliferate but do not differentiate. Embryonic stem cell lines can be isolated and then multiplied by continued culture. The importance of embryonic stem cell lines is that, if they are incorporated with normally developing embryos, they will participate in the formation of the inner cell mass and produce chimaeric animals, including germ line chimaeras which are fertile. A more direct route of regenerating animals from embryonic stem cells might be to use the nuclei from these for nuclear transplantation into enucleated oocyte and embryonic multiplication.

6. Chimaeras

Chimaeras mean the animals having body cell population with different karyotypes which have been formed from two or more zygotes with different karyotypes. Chimeric embryos have been frequently made by the aggregation of cells from two individual embryos or by injecting cells from one embryo into the blastocyst cavity of another embryo. So long as cells from both embryos are represented in the inner cell mass, the composite embryo will develop into a chimaeric animal. A more important aspect of chimaerism in genetic conservation is the potential use for inter-species embryo transfer. Using this technology sheep have been born to goat foster mother and vice versa. This would be especially important if it was a species rather than a breed of animal that was on the verge of extinction.

7. Production of embryos *in vitro*

This technology involves salvaging mature oocyte from ovaries of slaughtered animals and developing methods for their maturation, fertilization and *in vitro* culture for normal embryonic development. For conservation of rare breeds, such a method could provide an opportunity to salvage a few oocytes from the ovaries of rare and superior animals even after their normal reproductive life and to produce some blastocysts for conservation by deep freezing.

8. Embryo splitting

Embryo splitting is more advantageous in the circumstances where only few embryos of particular genotype or breed or species are available. This technique of manipulating embryos could be helpful in producing more number of animals from a few stored embryos of rare and endangered animals.

9. Transgenesis

Recent developments in molecular biology have enabled introduction of specific genes into the animal genome. A

small amount of DNA is injected into the nucleus of an egg soon after fertilization. In some instances the DNA becomes integrated into the chromosomes and an embryo and fetus develops in which all the nuclei contain copies of the inserted gene. As any sequence can be spliced with any other (Anderson, 1986) ^[1], transportation of genes across breeds and species is possible by recombinant DNA techniques. Successful microinjection of genes in mice embryo and their expression (Gordon *et al.*, 1980; Palmiter *et al.*, 1982, 1983) ^[7, 11] has made the creation of transgenic forms a possibility, and for the future a viable technique for improving animal production, and for conservation and capitalize on of important genes across breeds and species.

10. DNA libraries

Theoretically, an animal can be produced from its complete DNA complement. However, at present technical developments are limited to the identification and manipulation of only a few genes. But the direction in which technical advancements are taking place gives an indication that in future breeds/species can be reconstructed from their DNA complements. This gives the hope that if complete DNA complement is stored either in lyophilised form or as cryo preserved cells, reconstruction can be taken up when techniques are standardised. Advances in biotechnology are emerging in a big way and could be of great utility in near future for animal improvement and animal genetic resource conservation programmes. These techniques need to be standardized in a more simple and pragmatic way for conserving country's animal genetic resources. Applications to genetic conservation are very justified and future programmes should certainly be evolved in which all the opportunities emerging from new biotechnologies may be exploited. In situ and ex situ conservation schemes are complementary, not mutually exclusive, with their application for a particular animal genetic resource depending on farmers' current use of it and its comparative uniqueness. Furthermore, frozen germplasm can play an important role in the support of in situ breed develop schemes.

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 utilized 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's 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 utilized in conservation.

Future strategies

The object in conservation and improvement should be considered not only on economic traits but also aimed at the

reproductive and survivability in a given eco-system Policies for genetic conservation and those for genetic improvements (selection programs for commercial exploitation) have opposing objectives. Commercial livestock systems are likely to result in genetic uniformity, wherein further improvement is not possible. These two policies can be made compatible and genetic loss resulting from selection programs can be minimized. Conservation programs are applied in case of farm animals, through the medium of recognized breeds of livestock. The techniques advocated to maintain genetic variability include the use of high ratio of males to females breeding stock, and the application of random breeding system. These are intended to minimize genetic drift and inbreeding, which are the features of small, closed population and to prevent genetic change in populations subject to artificial selection pressures. Maintenance of the breeds in small numbers especially in the Government livestock farms, research institutes and with breeders at field level in the respective breeds tracts could be considered immediately. Since the number of cattle breeds and their variants are high, and the funds available is less, the conservation program should be initially restricted the more economic and presently used breeds of cattle. As more funds become available, the other breeds can be thought of to be conserved from the historic point as well as for posterity. Immediate strategies

would involve the Survey, Conservation of Livestock Genetic Resources, Research on Conservation and Training in Conservation and Management. Serious efforts should be made to organizing conservation and evaluation strategies. Since the major emphasis in any system of conservation is the lack of information in gene resources, it is absolutely important that evaluation and conservation should go hand in hand and can be achieved by the following: 1. All universities, educational institutions, religious trusts and organizations associated or having interested in historical preservation should be aided by the Government and encourage to maintain small groups of animals in their natural habitat or intended management systems. These groups should be under a uniform recording system, in a computer readable format with the evaluation and documentation being done at the NBAGR. 2. All the developmental programs being taken up by the state governments should have a mandatory pre-requisite that breeds being used for crossbreeding or grading up should be maintained in nuclear herds in their natural habitat and subjected to continuous evaluation as described above.

Annexure I Recognized indigenous breeds of cattle

S. No.	Breed	Breeding tract	Population (as per 2007 census)*
1	Gir	Gujarat (Junagarh, Bhavnagar, Amreli Distt)	2,103,307
2	Rathi	Rajasthan (Bikaner, Jaisalmer & Ganganagar Dist)	924,087
3	Red Sindhi	Pakistan (Karachi and Hyderabad Dist)	549,432
4	Sahiwal	Pakistan (Sahiwal Dist), Ferozpur and Amritsar Dist. Of Punjab	457,405
Dual purpose Breeds			
5	Deoni	Maharashtra (Marathwada region) adjoining parts of Karnataka and AP	166,025
6	Gaolao	Maharashtra (Wardha Dist), MP (Balaghat, Chhindwara Dist), Chhattisgarh (Durg, Rajiandgoan)	222,663
7	Hariana	Haryana(Rohtak, Hissar, Jind dist), Rajasthan (Alwar, Bharatpur)	2,600,122
8	Kankrej	Gujarat(Kutch, Mehsana, Ahmedabad, Kaira, Sabarkantha dist), Rajasthan (Barmer & Jodhpur)	3,887,152
9	Krishna Valley	Karnataka (Belgam, Raichur, Bijapur dist), Maharashtra (Satara, Sangli, Solapur)	2,314
10	Mewati	Rajasthan (Alwar, Bharatpur), Uttar Pradesh (Kosi, Mathura Dist)	75,427
11	Ongole	Andhra Pradesh (Chittor, Kurnool)	258,240
12	Tharparket	Rajasthan (Jodhpur, Barmer, Jaisalmer)	557,679
Draft Breeds			
13	Amrit Mahar	Karnataka(Hassan, Chikmagalur Chiteradurga)	98,169
14	Bargur	Tamil Nadu (Erode Dist)	21,315
15	Bachaur	Bihar (Sitamari, Madhubani, Darbhanga Distt)	451,659
16	Binjharपुरी	Orissa (Jaipur Subdivision Cuttack Dist)	46,680
17	Dangi	Maharashtra (Nasik, Ahmednagar Dist)	304,238
18	Ghumsuri	Orissa (Cuttack Dist)	82,815
19	Hallikar	Karnataka	2,196,698
20	Kangayam	Tamil Nadu (Erode Distt)	316,114
21	Kenkatha	Uttar Pradesh (Lalitpur, Hamirpur, Badnda Distt), Madhyapradesh (Tikamgardh Dist)	185,886
22	Kherigarh	Uttar Pradesh (Lakhimpur Kheri Distt)	171,414
23	Kheriar	Orissa	
24	Khillari	Maharashtra (Solapur, Sangli Satara Dist)	1,423,742
25	Malvi	Madhya Pradesh (Dewas, Ujjan, Sajaipur dist, Rajasthan (Jhalawar Dist)	1,518,452
26	Nagori	Rajasthan (Nagaur Distt)	837,344
27	Nimri	Madhya Pradesh (Khandwa, Khargaoan and Barwani Dist)	309,859
28	Motu	Orissa (Koraput Dist)	702,347
29	Ponwar	Uttarpradesh (Pilibhit Dist)	24,072
30	Red Kandhari	Maharashtra (Nanded Dist)	1,78,758
31	Siri	West Bengal (Darjeeling) and Sikkim	61,764
32	Umlachyery	Tamil Nadu (Thanjavur, Nagapattinam Dist)	218,315
Dwarf Breeds			
33	Vechur	Kerala (Vaikam, Kottayam distt)	3,170
34	Punganur	Andhra Pradesh (Chittoor)	771
	Total		20,954,432

Indigenous breeds of Buffalo

S. No.	Breed	Breeding tract	Population (as per 2007 census)*
1	Murrah	Haryana (Rohtak, Hissar distt)	20,488,438
2	Nili Ravi	Punjab (Ferozepur Distt)	591,659
3	Bhadawari	Uttar Pradesh 9Agra, Etawah distt), Madhya Pradesh (Bhind, Gwalior Distt)	729,013
4	Jaffarabadi	Gujarat (Amreli, Junagarh, Bhavnagar Distt)	1,843,848
5	Marathwada	Maharashtra (Marathwada Region)	183,238
6	Mehsana	Gujarat (Mehsana, Ahmedabad)	3,376,196
7	Nagpuri	Maharashtra (Vidharbha Region)	142,765
8	Phandharpuri	Maharashtra (Kohlapur, Sangli, Solapur dist)	272,802
9	Surti	Gujarat (Kheda, Vadodra, Bharuch distt)	2,988,245
10	Toda	Tamil Nadu (Nilgiris, Udagamandalam, Coonoor dist)	54,755
11	Banni	Gujarat (Kutch distt)	527,576
	Total		31,198,535

Conclusion

The number of indigenous cattle population is decreasing constantly due to the overwhelming influence of mechanization of agriculture and crossbreeding programmes. Conservation of domestic cattle breeds of cattle is essential due to their potentiality for production or draught capability or high resistance to diseases and heat tolerance ability. All the available cattle genetic resources cannot be conserved due to the high cost involved, hence, conservation should be aimed at the those breeds which are immediately useful to the farmer. In situ conservation is the method of choice for conservation. However, ex situ methods of conservation such as frozen semen preservation can be complementary. Other ex situ methods can be utilized once they are standardized and are cost effective. NBAGR (National Bureau of Animal Genetic Resources) will be the national focal point in this programme while the regional focal points will be the state agricultural universities, educational institutions, religious trusts, other non-government organizations along with the farmers at the field level.

Conflict of Interest

Not available

Financial Support

Not available

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