

Animal Genetic Resources (AnGR) Diversity in India

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The history of farm Animal Genetic Resources (AnGR) is about 12 to 14 thousand years old; started with the domestication of the animals for companion, food, fur and hide purposes. Among 40 non-carnivores livestock species domesticated by human being, till date, only cattle, sheep, goat, pig and chicken are highly prevalent and known as 'Big five'. Other species like buffalo, dromedaries and Bactrian camel, llama, alpaca, yak, and mithun are region specific. At present, about one-fifth of the global food is of animal origin in the world. A vast genetic diversity of AnGR has been generated during hundreds of years through culmination of various evolutionary forces, including intensive selection and preferred mating by human for various utilization purposes. Initial domestication modulated the wild ancestors to adapt to human habitation and making themselves more useful for the human being. Migration of animals by humans across the continents further disseminated the germplasm, initiating the diversification of the farm animals across the globe. However, artificial selection for different needs and likings by the human is the chief element for development of large-scale genetic diversity, in form of distinct breeds and populations. These breeds as well as specialized populations have been evolved for a specific need or utilization pattern like milk, draft, meat, fibre, carting, riding etc. Today, the world possesses more than eight thousand livestock and poultry breeds, evolved from only few founder populations and catering various needs of human society around the world. As per Global data bank on Animal Genetic Resources of FAO, a total of 8774 breeds of 38 species were reported, worldwide (data from 182 countries) in 2014. Among these, 7718 are local breeds (in one country) and 510 are regional transboundary breeds (in one region) and 546 are international transboundary breeds (in more than one region).

Breed Evolution and Diversity in India

India possesses 11 farm livestock species – cattle, buffalo, sheep, goat, pig, horse, donkey, camel, yak, mithun and rabbit and few domesticated poultry species – chicken, geese, duck, Guianese fowl, Japanese quails etc. In India, there are 536.82 million livestock and 851.12 million poultry (Livestock Census, 2019). The species wise proportion of total livestock is 36.04% cattle, 20.47% buffalo, 27.74% goat, 13.83% sheep, 1.69% pig and rest 0.23% represented by mithun, yak, horses and ponies, mule, donkey and camel.

In fact, Indian subcontinent has witnessed the earliest domestication of many farm species including Indicine cattle, buffalo, goat and poultry. In Indus civilization, cattle husbandry was main occupation playing important role, both in nutritional as well as economic, in their society. Selection of animals for specific work, based on specific traits, has laid foundation of breed formation in Ancient India. In an ancient literature of Parini's "*Astadhyayi*" first time described four types of cattle-Halika, Sakat, Rathya and Sairika based upon their work type. Different use of cattle during Arya era laid

the initial foundation for the breed development. Some best cattle breeds like Ongole and Gir, probably most ancient breeds of any farm animal across the world. Some of the breeds like Devni, Amrit Mahal, Gao Lao have been evolved about three centuries back.

Currently, in India, there are 199 registered indigenous breeds of livestock and poultry, which include 50 of cattle, 19 of buffalo, 34 of goat, 44 of sheep, 7 of horses and ponies, 9 of camel, 10 of pig, 3 of donkey and one of yak in livestock and 19 of chicken, one of geese and two of duck in poultry. Three breeds of indigenous native dog have also been registered recently, the first time in the country. During the last 10 years, more than 100 new populations were identified across the country and 73 breeds of different farm animal species were registered. Breeds of species like pig, donkey, yak, dog and geese were first time registered in the country (Table 1) in the last decade. With a greater pace, 40 new breeds were added in only last 4 years (2017-19 to 2020-21). Importantly, a number of breeds were registered from remote areas like NEH and also for the minor species; which are although less

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Table 1. Species-wise number of breeds

Species	Extant breeds	New breeds	Total breeds
Cattle	30	20	50
Buffalo	10	9	19
Sheep	39	5	44
Goat	21	13	34
Horse	6	1	7
Pig	0	10	10
Camel	8	1	9
Donkey	0	3	3
Yak	0	1	1
Chicken	15	4	19
Duck	0	2	2
Geese	0	1	1
Dog	0	3	3
Total	129	73	202

in population but contributes significantly to the society. A number of new breeds have also been reported from the remote regions of the country. Like North-Eastern states have registered 21 breeds in recent time (Table 2). Many of the new breeds have been added in breed inventory by the states like Gujarat, Odisha and Tamil Nadu, mainly because of active participation of local agencies and NGOs in these states.

Some of the regions, like Rajasthan, Gujarat, North Eastern states are rich in breed diversity, mainly because of their unique production systems. In fact, many of the breeds evolved due to specific production system in country. For example, pastoralism is a unique production

system of rearing, which has led to the development of many livestock breeds. The nomadic herding community from western India, especially Gujarat and Rajasthan, is responsible for the development of many famous breeds. Gir, Kharai, Nari, Sanchori cows, Banni buffalo, Kachhi, Khadai camel are developed by the pastoral community. More than 60 breeds reared by pastoralists have been recognised and registered till date.

However, considering country's vast geographic and ecological regions, contrasting climatic conditions along with diverse necessity of the farmers, there is still a sizable undefined population, particularly those of cattle and goat. With 10 percent of the global livestock population, the country possesses only 4 percent of the total breeds. There is one breed per 3 million livestock population in India, which is much lower than the world average (one breed per 0.9 million animals), about 4 to 6.5 million for cattle, buffalo and goat, the three most populous species in India. FAO also predicted a greater number of livestock breeds in the country. About 54 percent of total livestock is non-descript, as per recent breed survey (DAHD, 2022). It included 52.0 % of cattle, 45.4% of buffalo, 50.6% of sheep, 63.5% of goat and 56.3% of pig as non-descript. There are a number of states like Madhya Pradesh, Chhattisgarh, Jharkhand, Bihar, Uttar Pradesh, West Bengal, Telangana etc. which are rich in AnGR diversity and have large proportion of non-descript population.

Table 2. State-wise number of breeds

State	New breeds(2010-21)			Total breeds			State	New breeds(2010-21)			Total breeds		
	Pr.	Sec.	Total	Pr.	Sec.	Total		Pr.	Sec.	Total	Pr.	Sec.	Total
Rajasthan	2	1	3	24	5	29	West Bengal	1	0	1	4	1	5
Gujarat	8	1	9	23	4	27	Andaman & Nicobar	2	0	2	3	-	3
Tamil Nadu	8	0	8	21	0	21	Chhattisgarh	2	0	2	3	0	3
Maharashtra	3	0	3	13	1	14	Haryana	1	0	1	3	3	6
Jammu & Kashmir	3	0	3	11	0	11	Nagaland	3	0	3	3	0	3
Karnataka	4	1	5	11	5	16	Sikkim	0	0	0	3	0	3
Odisha	9	0	9	12	2	14	Uttarakhand	3	0	3	3	1	4
Uttar Pradesh	3	1	4	11	3	14	Arunachal Pradesh	1	0	1	2	1	3
Andhra Pradesh	0	1	1	7	2	9	Goa	2	2	4	2	2	4
Assam	5	0	5	7	0	7	Manipur	1	1	2	2	1	3
Himachal Pradesh	2	1	3	7	1	8	Meghalaya	1	1	2	2	1	3
Punjab	2	0	2	6	0	6	Jharkhand	0	1	1	1	1	2
Bihar	3	1	4	5	1	6	Mizoram	1	0	1	1	0	1
Kerala	0	0	0	4	0	4	Telangana	1	0	1	1	0	1
Madhya Pradesh	0	0	0	4	4	8	Tripura	1	0	1	1	1	2

Pr. - Primary home tract; Sec.- Secondary home tract

ICAR-NBAGR: Committed to Preserve Farm Animal Biodiversity of the Country

Established on 21st September 1984, ICAR-National Bureau of Animal Genetic Resources (NBAGR) is working with a mission to protect and conserve indigenous Farm Animal Genetic Resources for sustainable utilization and livelihood security, with many important national and international commitments, to date. The bureau has achieved a number of milestones, including registration and notification of 202 native animal breeds from all parts of the country, during its small stint. This has enabled the recognition of almost 50 percent of native livestock of the country as descript. About 230 breed/populations of indigenous livestock and poultry were characterized and documented by the Bureau. It included, 120 newly identified breeds/populations of indigenous animals across the country. Further, with a target towards zero non-descript AnGR in the country, the bureau has also initiated a country-wide survey in collaboration with State AHDs, SAUs in mission mode. For the long-term conservation program as also included under SDG Indicator 2.5.1, the bureau has cryopreserved the germplasm for native breeds in form of Semen (49 breeds/populations), Somatic cell (24 breeds/populations) and DNA (169 breeds/populations) at National Gene Bank of the Bureau. Further, the bureau has also conserved 17 threatened breeds, in their native tracts through involving livestock keepers and stakeholders under the network program on AnGR. The knowledge about genetic diversity and genomic uniqueness of native breeds has been enriched through genomics research. The molecular genetic work carried out at NBAGR has resulted in some important technologies including SNP chips for almost all livestock species. High-end research at the bureau has also enabled us to identify unique traits like thermotolerance, endurance as well as the uniqueness of the products of native breeds; which would help in the value addition of native breeds. Omics based trait characterization for climatic adaptation, heat/ cold tolerance in native cattle, buffalo and sheep breeds and unique animal products- Milk (Sahiwal), colostrum (cattle/yak) Meat (Kadaknath) are hallmark research initiatives. AGR-IS database is available with all kind of information on native breeds in the country. Bureau is actively involved in creating awareness about the indigenous livestock, their upkeep and conservation through interactions with farmers during their visits to the breeding tracts. Bureau is encouraging the conservation efforts of the farmers and pastoralists through bestowing them Breed Conservation Award and Breed saviour awards. More than 100 farmers/livestock keepers belonging to different states have been awarded for recognizing and conserving native breeds and populations. The Bureau has borne the greatest responsibility towards native animals and their keepers and striving hard to protect the precious animal biodiversity.

Mission towards Zero Non-descript AnGR of India: A new initiative for identifying new breeds

ICAR-NBAGR has taken the initiative to characterize and document all non-descript animal genetic resources of the country. The task has been taken under Mission towards Zero Non-descript Animal Genetic Resources of India, launched by Secretary DARE & DG, ICAR on 11th August, 2021. The Mission would encompass the activities in all states of the country in collaboration of the state Animal Husbandry departments/ SAUs/SVUs/NGOs ICAR-NBAGR. Bureau has initiated documentation of native AnGR in 22 states/UTs. For sensitization of the stakeholders the institute is also organizing State Interface Meets and after the launch of the mission, interface meets with 12 states have been completed. At present, projects on documentation of AnGR are being implemented in 22 states/UTs in collaboration with State Animal Husbandry Departments, KVKs, ICAR institutes and SVUs/SAUs. Bureau's scientists have made the visits in various states after launch of the Mission towards Zero Non-descript AnGR. About 18 new populations of native livestock and poultry have been identified after launch of Mission, which are being characterized in their respective breeding tracts falling in various states.

Breed Registration and Gazette Notification: A Framework for Recognising Native Germplasm

Registration of livestock and poultry genetic resources has been initiated to protect and check the biopiracy of indigenous AnGR. Our country has a mechanism for recognizing the valuable sovereign animal genetic resource with known characteristics in form of a national documentation system. Registration of breeds of native livestock and poultry has greater impact in livestock sector in the country. In the year, 2008, ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal was given the temporary authority for the registration of germplasm related to livestock and poultry in the country. First time in the year 2008, all 129 extant breeds of livestock and poultry were registered by the NBAGR. Further 73 breeds were newly added and by 2021, the number reached 202. Further, to provide legal safeguards for germplasm protection, notification of indigenous breeds has started in the year 2019 through publishing Official Gazette by the Government of India. The Government of India has notified all 202 breeds for keeping and rearing for the purposes of animal husbandry, production, breeding, conservation, utilization, consumption, and trade through five Gazette Notifications between 2019-2021.

Registration and, further notification of breeds has certainly broadened its impact through modulating various policies and programmes. Along with preserving the biodiversity as mandate under Delhi Declaration (2016), the stakeholders specially Farmers would be the most benefitted. After breed designation, superior quality germplasm of the breed become available to the livestock owners. Notification provided legal support to Intellectual Property Rights (IPRs) of the registered breeds and for developing mechanism for sharing benefits among the animal keepers.

Risk to AnGR Diversity

History of protecting and utilizing the native germplasm is long but international framework for their sustainable utilization along with preservation of biodiversity could be established in Earth Summit held at Rio de Janeiro in 1992. Convention on Biological Diversity (CBD) of Earth Summit has endorsed sovereignty of any country over its genetic resources, including AnGR. It has necessitated to protect AnGR through developing appropriate policies

in the country. A number of steps, internationally and nationally has been taken since then, specially related to the protection of AnGR biodiversity. To mention, Global Plan of Action for AnGR of FAO (Interlaken Declaration) in 2007, CBD-Nagoya protocol for Access & Benefit Sharing and Indigenous Knowledge in 2010, Aichi Biodiversity Targets of CBD in 2010. Recent UN's Sustainable Development Goals also envisaged management of all genetic resources globally specifically to promote sustainable agriculture and achieving food security. India also has its legal bindings to all these conventions and declarations and striving hard to protect its genetic resources.

At present the loss of indigenous animal biodiversity is well evident, globally. Second Report on State of World's Animal Genetic Resources for Food & Agriculture (2015) of the FAO describes that only 17.7 percent breeds are 'Not at risk', globally. The risk status that the proportion of livestock breeds classified as being at risk of extinction has been increased from 15 percent in 2005 to 17 percent in 2014 in the world. A total of the world's 7.4 percent livestock and poultry breeds have come under 'extinct' and 16.6 percent under 'at risk' category. More than half (58.3 percent) of breeds have been classified as 'unknown' status of risk; further, indicates that the number of breeds at risk is likely to be underestimated, globally.

In India, Breed-wise Livestock Survey 2013 and 2019 conducted by DAHDF, Govt. of India, first time, gave the first indication about the population of the registered livestock breeds in the country. Taking in account the figures in survey, about 14 per cent of the total indigenous livestock breeds are seems to be under threat. The proportion of breeds under threat is much higher in minor species including camel and horses. Recently, Singh and Sharma (2017) assessed the risk status of major livestock species in country using the criteria lay down by FAO (2013).

Drivers of Change

In analysis of country reports by FAO, indiscriminate crossbreeding has been identified as most frequent cause of genetic erosion in the world and reported by maximum countries. Other drivers of change, listed in decreasing importance included – introduction and/or increased use of exotic breeds, lack of or weak AnGR policies, programme and institutions, breeds not profitable/competitive or have poor performance,

Indigenous Breeds at Risk*

Cattle	: Belahi, Pulikulam, Punganur
Buffalo	: Chilika
Goat	: Sumi-Ne, Chegu, Karnah, Teressa
Sheep	: Kachaikatty Black, Tibetan, Nilgiri
Pig	: Agonda Goan, Tenyi Vo
Camel	: Kharai, Marwari, Mewari, Mewati, Malvi, Jalori
Horse	: Zanskari, Kachchi-Sindhi, Bhutia, Spiti, Manipuri

*As per FAO criteria, DAHD-Breed Survey Report 2022

intensification of production or decline of traditional production system and disease management, loss of grazing land, inbreeding or other breeding problems, migration or uptake of alternate employment, change in consumer demand, mechanization, non-appreciation of local breeds, unspecified economic and market factors climate change, globalization and liberal trade, lack of infrastructure for production-processing and marketing and lack of interest among young generation.

The Drivers behind the decrease of most of the indigenous populations are numerous, however, the most evident drivers behind change of AnGR dynamics as well as depleting AnGR diversity are – decreasing utility and increasing pressure for production. Consistently high demand with changing production scenario has derived the preference for highly specialized breeds, which has attributed to the loss of genetic diversity of the livestock in general, and of indigenous breeds in particular. Consistently high demand with changing production scenario has derived the preference for highly specialized breeds, which has attributed to the loss of genetic diversity of the livestock especially indigenous breeds. The introduction of exotic germplasm especially of cattle, chicken, pig and sheep from agriculturally advanced economies has resulted in a serious erosion of highly adapted farm animal breeds. Mechanised agricultural and transport led the down-numbering of the farm animal breeds needed for draught, ploughing and utility as a pack animal. India in its Country Report 2 (2014) has also assessed the impact of drivers of change on AnGR biodiversity in the country in coming years. Economic, livelihood, or lifestyle factors affecting the popularity of livestock keeping were predicted to have a high impact on AnGR management.

Future Prospective and Action Points

- Exploring and characterizing new breeds of indigenous farm animals from all parts of the country is the utmost requirement. Completing documentation of all indigenous AnGR and inventory of breeds of the country should be the target for next five years. Mission towards zero non-descript AnGR would be the most fruitful effort, if implemented country wide and funded adequately. To characterize mixed population by means of molecular tools would be important to upgrade such populations with the closest breeds.
- With each of the registered breed, there should be the society of their breeders which would help to conserve, improve and better utilize the breed in local area. Such societies have been started to be evolved, but in few states like Gujarat, Tamil Nadu and Odisha etc.. Bureau has to have greater involvement in breed society formation.
- Cryopreservation of germplasm in form of semen/somatic cells/embryo should be completed for all registered breeds with sufficient genetic diversity. Cryopreservation at National level with National Gene Bank of advanced and state of the arts facilities. *In situ* conservation of breeds would only be effective through participation of stakeholders and farmers. There is need for true valuation and value addition of the AnGR and their products for long term conservation and sustainable utilization of the native breeds.
- Information System on all aspects of Animal Genetic Resources should be integrated at national and regional levels with active participation of all animal husbandry department and institutions like DAHD, NDDB, ICAR, State AH Deptt., state livestock boards, veterinary universities, NGOs etc.
- Establishment of statutory procedure and authority for protection of AnGR and their stakeholders' benefits. Gazette notification is one of the step forward in this direction. Specific act/regulatory policy for protection of breeds and their keepers knowledge, the benefit sharing as per Nagoyo protocol is highly required in similar line to the PPVFRA for the plant. Such Act would also be helpful to decide the rights and ownership for the synthetic animal varieties/strains used for commercial purposes.

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