



Indigenous Cattle (A2 Cattle) Conservation and Development- A Crucial Socioeconomic Component: A Review

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ABSTRACT

In the current assessment, an effort was made to examine Indigenous cattle, significant milch, drought-resistant and dual-purpose breeds for genetic advancement, conservation and future research. The flat forehead, drooping ears, fatty hump on the shoulders, and huge dewlap are traits of indigenous cattle. Along with producing A2 milk, they are renowned for withstanding heat, illness resistance, immunity to ticks and parasites and low maintenance requirements. The main causes of the extinction of indigenous cow breeds are crossbreeding with alien breeds, economic viability issues, marketing issues, low milk output, low milk fat percentage, utility loss, decrease in herd size and extensive mechanisation of agricultural operations. By raising public awareness of the benefits of the Indigenous cow breed and conducting research on them, indigenous cattle can be preserved. The term "conservation" refers to the preservation of genetic potential as well as its improvement and maintenance of a breed for use in the future. In the future, genetic advancement and conservation should be combined. The regional gene banks creation and inclusion of breeder communities, Gaushalas, NGOs and other pertinent parties in conservation initiatives.

Key words: Characterization, Conservation, Cultural value, Indigenous cattle breeds, Indian cattle population.

The world's largest and most diverse cattle genetic resources are found in India, one of the world's most bio-diverse nations. India has 192.46 million cattle, a significant livestock species, according to the 20th Livestock Census (2019), which accounts for 14.70% of the world's cattle population and around 35.94% of all livestock in India (Das and Patnaik, 2020). India has been fortunate to have access to a sizable population of native cattle with a diverse range of species. According to their utility either in dairying or in agricultural work, there are 50 clearly defined breeds in India, which are displayed in Fig 1 and are generally categorised into milch, drought and dual purpose varieties. For the purpose of doing agricultural tasks, many farmers relied on these draught animals.

Indigenous cattle are renowned for their amazing capacity for endurance under hot tropical climates, resilience to tropical diseases and low maintenance cost. The various indigenous breeds of agricultural animals are mostly the consequence of evolutionary processes. Because milk contains the A2 allele, which is thought to be beneficial for human health, indigenous breeds have recently gained relevance (Fernández-Rico *et al.*, 2022). They are a crucial component in agriculture. Due to haphazard breeding and the introduction of exotic germplasm through cross-breeding, many breeds are now vulnerable to rapid genetic deterioration and dilution (Mursyidin *et al.*, 2022).

Mechanization of agriculture and issues with dry animal selling are the main factors contributing to the population fall of indigenous cattle. In addition, a significant shift in cattle breeding policy in the past toward crossbreeding has led the farmers to raise more crossbred animals as there are economic considerations favoring buffaloes and crossbred cattle as dairy

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animals. The farmers cannot support the maintenance of animals during the dry season because they must compete with other milch animals like Murrah buffaloes and crossbred cattle. The number of indigenous cattle has decreased for a variety of causes, including low productivity, short lactation periods and a lack of progeny tested bulls. Agriculture's mechanisation has made the issue even worse. Another reason for the decline in the number of indigenous breeds is a drop in the extent of land holdings (Soumya *et al.*, 2022).

Native cattle must be saved because they are a breed that thrives in tropical climates and on the plains of the Indo-

Gangatic and can be kept on a low input, medium output basis. Native cattle are renowned for their ability to withstand extreme heat and their resistance to illnesses including trypanosomiasis, babesiosis and theileriosis (Nyamushamba *et al.*, 2017; Itege *et al.*, 2020).

The indigenous cattle may once again play a significant role in the field activities of small farmers in the future, in addition to producing A2 milk for the family, as land holdings are decreasing day by day. To meet the need of future generations, concerted efforts are needed to conserve and grow indigenous cattle. With the formation of the National Bureau of Animal Genetic Resources (NBAGR) Karnal in 1984 under the ICAR, the efforts in this area in India were launched (Pathak *et al.*, 2020). When a breed's population is on the verge of extinction or is considered endangered, it must be preserved. While conservation include both preservation and upgrading (improving) of the genetic potential as well as management of a breed for the future, preservation only addresses the ongoing maintenance of genetic diversity.

Value addition of cattle's products

Either the raw form of livestock products or the form after they have been enhanced are valuable. By modifying a product's place, time and shape to include qualities that are highly valued in the market, value addition refers to adding value to the product economically. One or two methods-first innovation-can be used to increase value (improving existing process, methods or services or creating new one). The next step is coordination, which refers to agreements between people responsible for product production and marketing (Ramirez *et al.*, 2021). Native cattle play a critical part in the economy of the country by providing milk and milk products, providing draught animal power and producing cow dung and cow urine. To add value to their raw milk, dairy farmers can manufacture a wide range of processed milk products, such as skimmed milk, toned milk, standardised milk, homogenised milk, flavoured milk and condensed milk. Cow milk is used to make a wide variety of

other dairy products, including curd, buttermilk, butter, ghee, cheese, khoa, chhana, paneer, ice cream, lassi and more. These goods are very nutritious and therapeutic. The government buys cow manure from farmers and villages who own cows. This has made it possible to engage in a variety of trade operations that generate jobs and have the potential to strengthen the rural economy. The fertility and productivity of the soil can be improved by using cow manure. A variety of organic fertilisers can be generated from cow dung, including cow dung compost, which is a natural fertiliser. Many ayurvedic medications contain cow dung, which is approved for human consumption. The various cow dung goods include: bright Diwali diyas, Ganesha and Lakshmi idols, nameplates, mobile stands, candle stands, flower pots, key chains, incense sticks and herbal gulal for the Holi holiday (Singh, 2021). Gomutra, often known as cow urine, is a liquid waste product of cow metabolism. That is a blessing for everyone, but especially for farmers. Insect repellents, organic and natural fertilisers and other agricultural products are made with cow urine. soap, shampoo, incense, gaubhasma, panchagavya, vermicompost, gaunyle and insecticides manufactured from cow urine.

Indian cattle wealth

In 1919, India conducted its first livestock census. It has been done once every five years ever since. After India gained its independence, a livestock census conducted in 1951 found that there were 155.3 million cattle in the country overall. This number steadily increased until 1992, after which it decreased from 1997 to 2003 but increased from 2007 to 2012, when it was reduced to 190.90 million and finally increased to 192.50 million in 2019. (20th Livestock Census, 2019). Fig 2 shows the trend of cattle population in India.

In comparison to the 2012 census, there is an increase in cattle population of 0.83%. In comparison to 2012, there were 6.0% less native cattle, while there were 26.9% more exotic/crossed breed cattle. These statistics are shown in Table 1. Uttar Pradesh, Madhya Pradesh and West Bengal are the states with the most indigenous cattle (Fig 3).

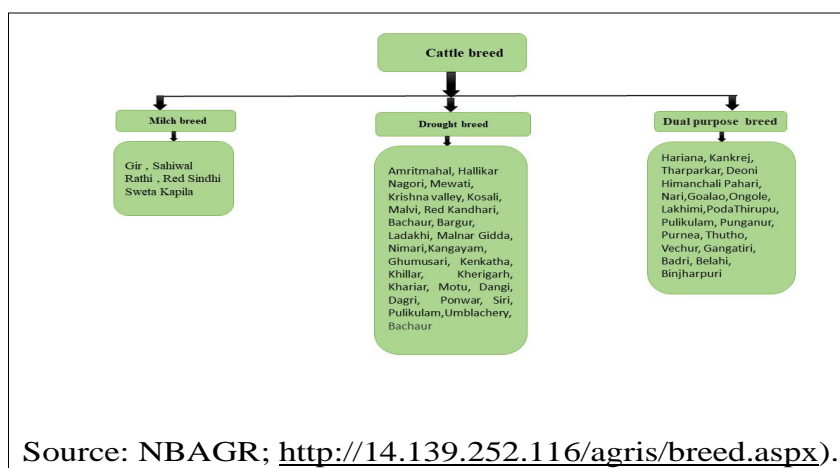


Fig 1: Well-defined indigenous cattle breeds.

Unique characteristics of indian cattle breeds

South Asia, specifically the Indian subcontinent, is the origin of domestic cattle known as indigenous cattle (*Bos indicus*), also referred to as humped cattle or indicus cattle. Their flat forehead, drooping ears, fatty hump on the shoulders and significant dewlap are characteristics. Indigenous breeds have certain traits that make them ideally adapted to the tropical climate, such as tolerance to heat, resistance to ticks and parasites, resistance to disease, ease of calving, resistance to drought and tolerance to bloat. It is well established that environmental heat stress has a negative effect on dairy animals' milk production, fertility, feed intake and growth rate. Because the HSP70 gene family in cattle

Table 1: Comparison of indigenous and exotic/cross breed cattle population during 2012 and 2019.

Category	Population (in million) 2012	Population (in million) 2019	% Change
Indigenous breed	151.17	142.11	-6.0%
Exotic/Cross breed	39.73	50.42	+26.9%
Total cattle	190.90	192.50	+0.83%

Source: 20th Livestock census, 2019.

has a unique genetic polymorphism that may be linked to controlling gene expression or protein function in response to temperature stress, the *Bos indicus* breeds of cattle are more thermotolerant than the *Bos taurus* varieties (Rehman *et al.*, 2020; Hansen, 2020).

Whey protein and casein protein are both present in milk. Only casein, which makes up 80% of the total protein in milk and the remaining 20% of whey protein make up the largest protein category (Lin *et al.*, 2021). Milk has a variety of casein forms, with α -casein being the second most prevalent. There are at least 13 distinct types of casein. A1 and A2 casein are the two varieties of α -casein that are used most frequently. Sahiwal, Gir, Red Sindhi, Kankrej and other indigenous/Desi cow breeds produce milk that is high in A2 α -casein and are recognised as sources of healthy milk (Jiménez-Montenegro *et al.*, 2022).

Schemes for conservation and development of indigenous cattle in India

The Government of India has launched several central sector programmes to strengthen the dairy industry, including the National Program for Cattle Breeding and Dairy Development (NPBBDD), Rastriya Gokul Mission, National

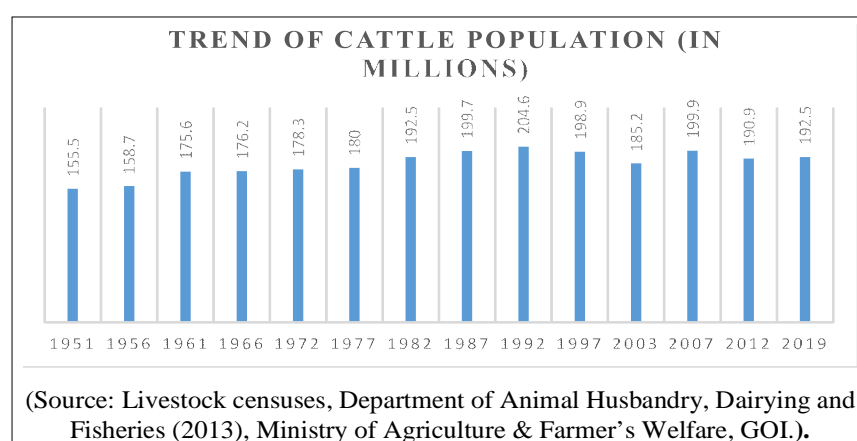


Fig 2: Trend of cattle population (in millions) in India.

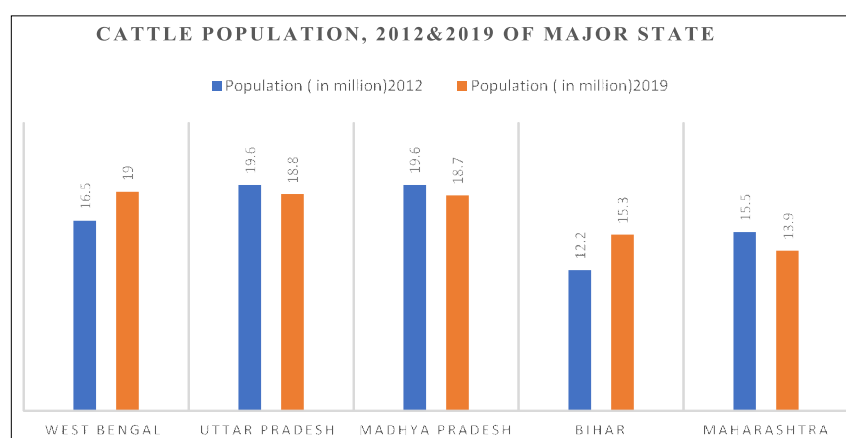


Fig 3: Cattle population, 2012 and 2019 of major state.

Program for Bovine Breeding, National Kamdhenu Breeding Center, National Dairy Plan-I, Central Herd Registration Scheme, Central Cattle Breeding Farms and Central Frozen Semen Production and Training Institute, Bangalore, which are being implemented to promote and protect the industry. In order to preserve and advance indigenous breeds in a targeted and scientific manner, the Rastriya Gokul Mission was established in 2014 (Martyniuk, 2021; Wani, 2022). The goal calls for the creation of integrated cattle development centres called "Gokul Grams" to promote indigenous breeds, up to 40% of which could be unremarkable breeds (Mandi *et al.*, 2018; Srivastava *et al.*, 2019). Under the National Program for Bovine Breeding and Dairy Development, the mission is a targeted project. The following are the main goals of this plan:

- Creation and preservation of native breeds.
- To implement a breed improvement programme for indigenous cattle breeds with the goal of enhancing genetic diversity and boosting the stock.
- To increase output and productivity of milk.
- To improve unremarkable cattle employing superior indigenous breeds like Red Sindhi, Gir, Sahiwal, Rath, Deoni.
- Objective to provide bulls with high genetic quality who are disease-free for natural service (Novoselov *et al.*, 2017).

By using more artificial insemination, the National Program for Bovine Breeding seeks to boost milk output (AI). Multi-Purpose AI Technicians in Rural India (MAITRIs) are developed, existing AI centres are improved, AI is overseen and other methods are used to achieve this (Pointet, 2022). The World Bank-backed National Dairy Plan-I seeks to boost milk production and productivity through the reinforcement of semen stations, a bull production programme (progeny testing and pedigree selection), a diet balancing programme and other activities to meet domestic milk demand. The government has set up the following three subordinate organizations:

- Centre for Cattle Breeding Farms (CCBFs).
- The Central Herd Registration Scheme.
- Institute for Central Frozen Semen Production and Training.

These organisations are also improving the genetics of milch animals by providing disease-free, highly genetically superior bulls for semen production and natural service for use in the breeding programme being implemented by the States (Pathak *et al.*, 2020).

The Central Herd Registration Scheme encourages the rearing of superior male calves and top cows by registering breeds of buffalo and cows that are of national significance. In order to complete the National Project for Cattle and Buffalo Breeding, it is essential to find the native germplasm needed. For use in the development programme, the initiative plays a significant role in assisting the Department of Animal Husbandry of States and Union Territories, Private Sector and Government Undertakings to acquire superior dairy cows and buffaloes, as well as bulls and offspring with high genetic potential (Kennedy *et al.*, 2018; Borghese *et al.*, 2022).

Strategies for the growth and preservation of indigenous livestock

Besides having various limitations as discussed above we have several strengths at our hands to support our cattle production programmes. India has basically been an agricultural country and is likely continuing to be so for a long time to come. Our socio-religious and agricultural system will require cattle production for milk, draft, manure, etc. We have vast cattle diversity which is reflected in 50 well defined breeds (Kumar *et al.*, 2019). This diversity needs to be exploited to meet the demand of animal protein for increasing human population whose food habits are based on milk and milk products. Livestock sector is an important component of our economy in terms of income, employment and foreign exchange earnings. Due to lack of systematic breeding of cattle under field conditions, the number of nondescript cattle is increasing. So, concerted efforts are required for the conservation and development of indigenous cattle to meet the demand of future generations (Tesfa *et al.*, 2017).

In the next five to ten years, it is essential that the identification, characterization, appraisal and documentation of the genetic resources be finished. A complete set of description of very breed should be generated based on various profiles, including their distribution, habitat, body conformation, adaption, production, reproductive ability and social economic aspects.

For conservation, the most critical steps are to monitor the population of breeds over a time interval, identify breeds at risk, prioritize the breeds for conservation preferably for *in situ* strategy. A breed-specific census of cattle must be undertaken on a national and state level, together with data on the ecologies in which they thrive. Breed wise livestock census can be best utilized to monitor the population status and trends of the cattle breeds. After identifying the breeds that are at risk, breeds for conservation can be prioritized in view of financial expenditure and available infrastructure forces which restrict the number of breeds for conservation at certain time.

Semen production facilities need to be strengthened for production of disease-free high-quality semen from high genetic merit bulls and disseminated at the farmers' doorstep. This can be achieved by establishing infrastructure for production and selection of genetically superior breeding bulls especially in the breeding tract of indigenous cattle. Facilities of data recording for production, reproduction, growth and diseases by registering a greater number of indigenous cattle in database for identification and evaluation of genetically superior animals is also important.

There may be situations where there is need for up-gradation of non-descript of cattle to be done. Under such circumstances grading-up of local cattle with milch breed (Sahiwal, Gir, Red Sindhi) and Dual purpose (Kankrej, Hariana, Ongole) breeds may be undertaken. However, a well-defined breeding plan should be developed in concurrence of futuristic need, availability of resources in different regions with avoiding problems of future degeneration of indigenous cattle.

Development of pastures at community and panchayat land may help small and marginal farmers to rear cattle on almost zero input system. A registered society for propagation and conservation should be started by Government or NGOs. *In situ* breed conservation centers and storage of cryopreserved germplasm in the form of frozen semen and embryo can also play a significant role in the conservation of breed (Trzcińska and Samiec, (2021).

It is advised that ICAR research facilities, Agricultural/Veterinary Universities and other laboratories launch programmes to examine and pinpoint advantageous adaptation features in local livestock. Value addition of product of indigenous cattle is new possibility for improving our conservation efforts. Efforts like identifying unique biomolecules, producing high quality products with value addition, better marketing and branding could be more important to conserve our indigenous breeds (Srivastava *et al.*, 2019).

Importance of cattle in society and economy

Cattle occupy a unique role in human history. Domesticated at an early stage of human civilization, they served through the ages as objects of worship and mythology. The excavations of Mohenjo-Daro and Harappa indicate the use of cattle in India as early as 5000 years ago. In Hinduism, the cow is a symbol of wealth, strength, abundance and selfless giving. Due to the milk they provide, as indicated in the Mahabharata, they are given the same regard as "one's mother." Numerous Puranic and Vedic legends feature them. Krishna the god was born into a cow herding household and given the name Govinda (protector of the cows). Additionally, according to Hindu mythology, Lord Shiva rides Nandi, a bull. Nearly every household in ancient India owned a few cows, which gave a steady supply of milk and a few bullocks, which served as draught animals. Need for development and conservation (Balakrishnan and Shukla, 2018).

Native cattle contribute significantly to society and the economy in a variety of ways, including social security, food security, work, income, draught and dung production. In terms of the owners' standing in society, the pets provide social security. Families, especially those without access to land, who possess animals, are in a better position than those who do not. Animals are frequently given as wedding gifts in many regions of the nation. Animal rearing is an element of Indian culture. Animals are employed for a variety of social and religious purposes. During numerous religious ceremonies, bulls and cows are worshipped. Many pet owners grow attached to their creatures (Das *et al.*, 2020).

For many families in India, especially the resource-poor ones that keep few heads of animals, cattle is a source of supplemental income. The sale of milk from cows will give livestock farmers a consistent income. Cattles as sources of revenue in times of need to cover expenses like marriages, medical care for sick people, child care, home repairs, *etc.*

The animals also act as moving banks and assets that give the owners financial security (Singh *et al.*, 2020).

CONCLUSION

Native cattle are well known for their exceptional milk, ability to withstand the hot, humid temperature of the tropics, resilience to tropical illnesses and inexpensive care costs. This type of breed has played an important role in green revolution of the country by providing good quality milk bullocks. The strength of this cattle breeds that its milk production is least affected under adverse environmental conditions. Indigenous cattle are also getting importance due to the presence of A2 allele in milk, which is considered good for human health. Indigenous cattle have a high heat-resistance by virtue of their extensive dewlaps as compared to exotic breeds of cattle. In the natural breeding tract, the population of this significant breed of cattle is dwindling, which is cause for serious concern. Various factors identified which are responsible for decline in the population of Indigenous cattle which need to be taken into consideration for the conservation programme. The production potential of these animals has deteriorated over a period due to lack of selection and progeny tested bulls. Land holdings are declining day by day in India and under these circumstances the Indigenous cattle may again play an important role in farm operations of small or marginal farmers. Indigenous cattle breeds should be listed on a national watch list if they are in danger and should be preserved in their natural habitats using a participatory approach that includes breeders, communities, gaushalas, NGOs and other relevant stakeholders in conservation efforts. Further, increasing productivity through selective breeding or upgrading would help in averting the declining trends of population of indigenous cattle breeds and their sustainable utility such as milk production, draught power and dual-purpose breeds so that the Indigenous cattle can be saved for the use of future generations.

Conflict of interest: None.

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