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# Cattle and Buffalo Genetic Resources of India

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There are 50 registered breed of cattle and 19 breeds of buffalo in the country, these breeds are well adapted to diverse climate of the country and contributing significantly to the livelihood. India possesses 193.4 million cattle and 109.85 million buffalo in the year 2019. The crossbred and buffalo population has increased all the time since the livestock census initiated. Among the cattle and buffalo, 52% cattle and 45.4% buffalo population are non-descript and need to be defined on priority so their development programs can be initiated. India is home of best breeds of buffalo in the world i.e. Murrah and Sahiwal, Gir, Ongole and Tharparkar breeds of cattle. Mehsana and Niliravi are the breeds of buffalo those are equally good in performance in the country. Gir breed of cattle and Murrah breed of buffalo had maximum heads in the country. Breed wise trends during the years 2013-2022, showed that among the 37 cattle breeds included in breed survey/census, 15 are showing increasing trends and 22 showed declining trends. In buffalo, 13 breeds were included in breed survey/census, 4 are showing declining trends and 9 showed increasing trends. For improving the bovines in the country, we need to define non-described bovines on priority and registered unique population as distinct breed, if eligible, accurate breed census/survey, performance recording system at farmers door, ensure availability of superior germplasm, more population to be covered through Artificial Insemination and establishment of breed societies and breed nucleus farms adopting open nucleus breeding system.

## Introduction

Indigenous bovines are rich in variability and excellent in desirable attributes like disease resistance, tolerance to hot and humid stresses, adaptability to different environment and production systems and ability to utilize coarse roughages and crop residues. The breeds like Gir, Ongole and Sahiwal were introduced into different countries for their wide adaption and disease resistance qualities. The indigenous cattle milk carries A2 protein, which is superior to A1 protein that is found in the milk of crossbreed cattle. India is home tract of the world best buffalo breed i.e. Murrah, distributed to all parts of the country. India is also home tract of Niliravi and Mehsana buffalo those are equally good in performance as of the Murrah.

India's livestock sector is one of the largest in the world. It has 56.7% of world's buffaloes and 14.7% of cattle population. This sector is also supporting livelihood of more than two-thirds of the rural population. Most of the indigenous breeds of cattle were evolved for draft over the centuries. However, most of the buffalo breeds were evolved for milk. Purebred breeds of cattle and buffalo have been selectively bred over a long period of time to possess a distinctive identity in colour, size, conformation, and function and have the prepotency to pass these traits in to their progeny.

The world milk production in the year 2020 was 906 million tonnes and India contributed 22% by producing 198.44 million tons. The per capita availability in the country was 406 ml/day against the ICMR recommendations of 280 ml/day. The species wise contribution in milk production in India was indigenous buffalo 34.51%, buffalo non-descript 13.83%, indigenous cows 9.63%, indigenous cows non-descript 10.42%, crossbred cows 27.68%, cows exotic 0.98% and goat 2.95% in the year 2019. It revealed that indigenous bovines are contributing to 68.39% milk production in the country. Being the first ranked in milk production in the world, still milk production productivity (kg) per cow per day is very less i.e. indigenous buffalo 6.43, buffalo non-descript 4.51, indigenous cows 3.90, indigenous cows non-descript 2.57, crossbred cows 8.09, cows exotic 11.88 and goat 0.44. Efforts are needed to improve the milk productivity of different species in the country by defining the bovines (non-descript) of country and initiation of the genetic improvement programs.

In India, as per the 20$^{th}$ Livestock Census (Anonymous, 2019), 36.04% livestock population belong to cattle i.e. Second largest world cattle population.

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There are 193.4 million cattle in the country comprising 142.1 million indigenous and 51.3 million crossbreds. Among the cattle 26% are exotic/crossbreds, 22% are indigenous and rest 52% still need to be defined. Among the crossbreds 54.9% belong to Jersey or its crossbreds and 43.3% to Holstein Friesian and its crossbreds. Rest 1.8% belongs to other crossbreds. Among the indigenous cattle (142.1 million), 29.5% belongs to pure or grades of indigenous breeds and 70.5% are non-descript. In India, there are 109.8 million buffalo, world buffalo largest population comprising 54.6% pure breeds and their grades and 45.4% need to be defined. The pure breeds are 20.3% and grades of different breeds are 34.3%.

## Status of Bovines

Cattle population has increased by 23.9% since the year 1951. The indigenous cattle population has shown a decline of 13.1 million in the year 1951, as there were only indigenous cattle in the country. The first exotic/crossbred cattle population was reported in the year 1982 as 8.8 million which has increased tremendously to 51.3 million in the year 2019. West Bengal is the state which had maximum cattle population as 19.0 million in the country and shown an increase of 15.18% over the year 2012. Uttar Pradesh was the first state who had maximum cattle population in the year 2012 as 19.6 million but it reported a decline of 3.93% during the years 2012 to 2019 (Anonymous, 2019).

As per the Livestock census, 2019, the indigenous cattle are showing 0.8% increase over the last Livestock Census, 2012. The female cattle population had shown an increased by 18% over the year 2012 in the year 2019. The indigenous/non-descript female cattle population has shown an increase of 10% in the year 2019 over the year 2012. The exotic/crossbred cattle increased by 26.9% during the same period. There a decline of 6% in indigenous cattle population over the 2012, however it is less than 9% during the years 2007-2012. Cattle and buffalo populations and their trends over the years are shown in Figure 1.

The buffalo population in the year 2019 was 109.85 million in the country. It has increased 1.1% over the year 2012. In the year 2019, female population has increased by 8.61%, while males were declined by 42.35% over the same period. The buffalo population had shown an increase over all the time since 1951, a total increase of 66.45 million since the year 1951. The

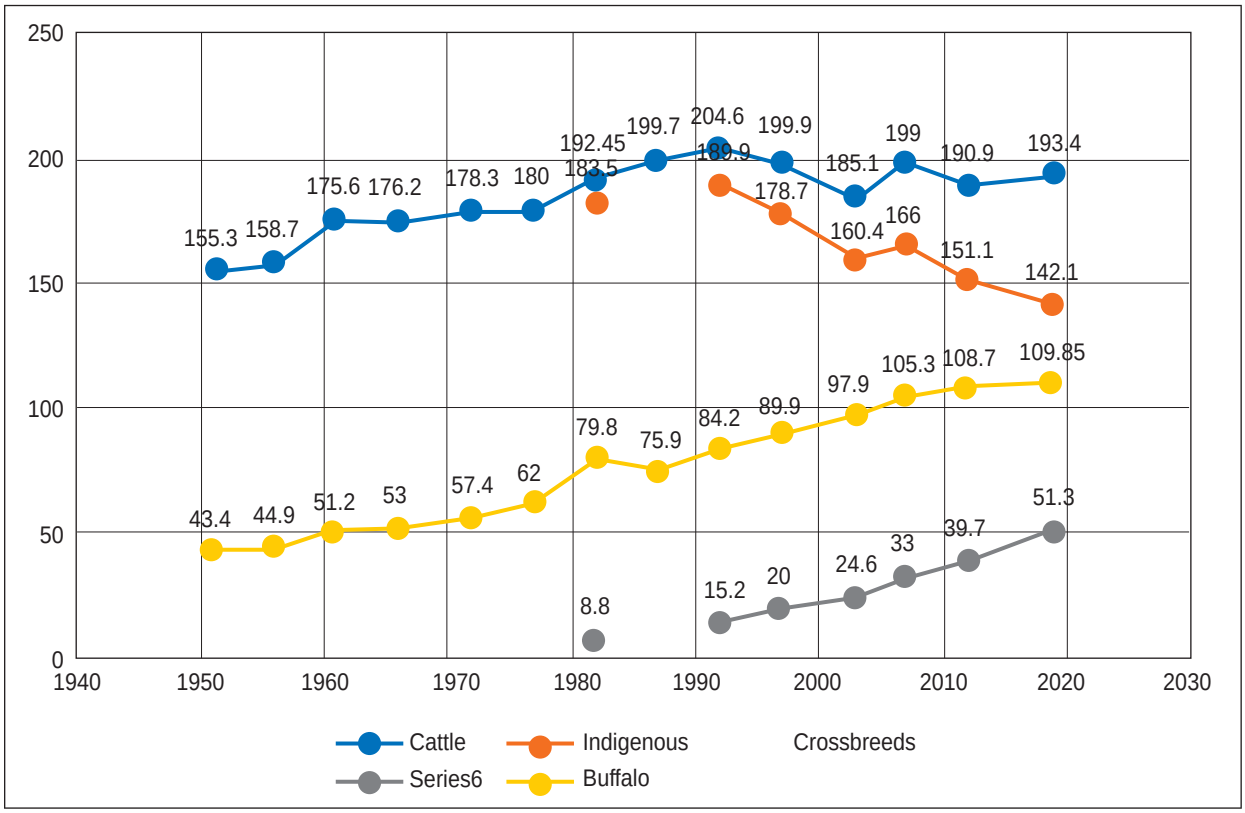


**Fig. 1. Cattle and buffalo population (millions) trends**

state Uttar Pradesh has maximum buffalo population (33 million) in the country followed by Rajasthan, Gujarat and Madhya Pradesh.

In India, there were 3 Breed Census/Survey Reports available in the country i.e. 2007 (Anonymous, 2007), 2013 (Anonymous, 2013) and 2022 (Anonymous, 2022. In The first Report (2007), there were pure breeds of different breeds counted, while grades of all breeds counted in a single figure, while in rest two reports (2013 and 2022) pure breeds and their grades counted separately.

As per the Breed Survey Report (2022), In India, there were 24.9 million pure breeds, 16.9 million grades of different breeds and 41.8 million non-descript cattle available among the indigenous cattle. There is significant increase in pure breeds cattle as compare to the Breed census Report (2013). The country had maximum number of Lakhimi breed (6.6 million) and contributing 4.8% of the total cattle population including it grades. The Gir breed is also contributing equally 4.8% but in it pure breeds are quite less (2.3 million) as compare to Lakhimi breed. The breeds those are contributing more than 1% population in India are Sahiwal, Bachur, Hariana, Kankrej and Kosali.

There are 22.3 million pure bred buffaloes and 37.6 million grades of different breeds available in the country. Murrah is the buffalo breed which has largest numbers of pure bred (14.2 million) and it grades (32.8 million), contributing 42.8% of the country buffalo population. The breeds those are contributing more than 1% of the country buffalo population are Mehsana, Surti, Jafarabadi and Bhadawari.

## Cattle Diversity

There are 50 recognised cattle breeds in India. Cattle breeds, their distribution and population over different years presented in Table 1. There were 30 cattle extant registered breeds in the country by the 2008. The new breed registration process was started in the year 2008 at ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana. Since the year 2008 to 2022, there were 20 new cattle breeds registered in the country i.e. Motu, Ghumusari, Binjjharpuri, Khariar, Pullikulam, Kosali, Malnad Gidda, Belahi, Gangatiri, Badri, Lakhimi, Ladakhi, Konkan Kapila, Poda Thurupu, Nari, Dagri, Thutho, Shweta Kapila, Himachali Pahari and Purnea.

All the breeds can be classified in to three categories as per their utility i.e. milk (Sahiwal, Tharparkar, Rathi, Red Sindhi and Gir), draft (Amritmahal, Hallikar, Kangayam, Khilar, Ponwar, Kherigarh and Krishna Valley etc.) and dual purpose (Kankrej, Hariana, Gangatiri, Deoni and Dangi etc.). Indigenous Zebu cattle (*Bos indicus*) have some distinctive features like a prominent hump, a long face, upright horns, drooping ears, dewlap and slender legs. The prominent body colour varies from white to gray and black. Zebus experience relatively lower basal metabolic rate and a superior ability for heat dissipation in comparison to their taurine (*Bos taurus)* counterparts. They easily adapt to the extreme tropical heat and acquire resistance to diseases, especially the tick-borne diseases. Zebu cattle, predominantly Ongole, Gir, Sahiwal and Tharparkar, have been imported, improved and propagated/crossed in sub temperate/subtropical regions, such as the southern United States, South America and Australia for developing tropically adapted dairy/beef cattle breeds in these countries.

The best Indian dairy cattle breeds viz. Red Sindhi, Sahiwal, Rathi, Gir and Tharparkar producing more than 2000 kg milk in a lactation of 300 days are mostly available in the north western region of the country. In southern region, most of the breeds are either dual purpose or draft purpose like Hallikar, Kangayam, Khillar and Krishna Valley. Breeds like Red Sindhi, Sahiwal and Tharparkar are available in Pakistan also. India maintains only small populations of these prized breeds and that too largely in a few organized herds. Since these breeds are well adapted to the local Indian environmental conditions, there is a pressing necessity for their protection from dilution through crossbreeding and their conservation and multiplication using latest scientific advancements. Information on Indian cattle genetic resources with regard to their utility, breeding tract and accession number is given in Table 1.

Indian cattle are mostly white/ grey coat color, however almost all the coat colors are available from grey to black. The southern breeds with white/grey coat colour include Amritmahal, Hallikar Pullikulum, Kangayam, Krishna Valley, Ongole and Punganur. Hallikar breed of southern Karnataka also have peculiar grey patches on the face. The grey coat colour in north west region breeds include Gangatiri, Gaolao, Hariana, Kankrej, Kenkatha, Kherigarh, Khillar, Malvi, Mewati, Nagori and Tharparkar. The breeds those had brownish

**Table 1. cattle and buffalo breeds, their distribution and population in different year**

| S. N. | Breed | Population (2007) | Population (2013) | Population (2022) | State(s) | S. N. | Breed | Population (2007) | Population (2013) | Population (2022) | State(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cattle breeds** | | | | | | | | | | | |
| 1. | Amritmahal | 96021 | 105343 | 104990 | Karnataka | 26. | Ladakhi | - | - | - | Leh and Ladakh |
| 2. | Bachaur | 454103 | 741432 | 3215259 | Bihar | 27. | Lakhimi | - | - | 6648519 | Assam |
| 3. | Badri | - | - | 741324 | Uttrakhand | 28. | Malvi | 1515753 | 1158172 | 595658 | Madhya Pradesh |
| 4. | Bargur | 20879 | 14154 | 42300 | Tamil Nadu | 29. | Malnad Gidda | 1282121 | 899091 | 631530 | Karnataka |
| 5. | Belahi | - | - | 4238 | Haryana and Himachal Pradesh | 30. | Mewati | 75427 | 14773 | 9024 | Haryana Uttar Pradesh |
| 6. | Binjharpuri | 29749 | 79428 | 69406 | Odisha | 31. | Motu | 700908 | 469320 | 231954 | Odisha |
| 7. | Dangi | 303630 | 119373 | 139971 | Maharashtra Gujarat | 32. | Nari | - | - | - | Rajasthan |
| 8. | Dagri | - | - | - | Gujarat | 33. | Nagori | 837334 | 373224 | 210012 | Rajasthan |
| 9. | Deoni | 165846 | 151236 | 183656 | Maharashtra Karnataka | 34. | Nimari | 309237 | 341828 | 398341 | Madhya Pradesh Maharashtra |
| 10. | Gangatiri | - | - | 243153 | Uttar Pradesh Bihar | 35. | Ongole | 257661 | 115905 | 303817 | Andhra Pradesh |
| 11. | Gaolao | 222566 | 121538 | 112563 | Maharashtra Madhya Pradesh | 36. | Poda Thurpu | - | - | - | Telangana |
| 12. | Gir | 2126421 | 1380208 | 2300090 | Gujarat | 37. | Ponwar | 24072 | 20067 | 14480 | Uttar Pradesh |
| 13. | Ghumusari | 82117 | 58855 | 35626 | Odisha | 38. | Punganur | 733 | 2772 | 9876 | Andhra Pradesh |
| 14. | Hallikar | 2191486 | 1211242 | 501057 | Karnataka | 39. | Purnea | - | - | | Bihar |
| 15. | Hariana | 2600111 | 1639181 | 1179089 | Haryana, Uttar Pradesh, Rajasthan | 40. | Pulikulam | - | 7352 | 10495 | Tamil Nadu |
| 16. | Himachali Pahari | - | - | - | Haryana, Uttar Pradesh | 41. | Rathi | 924057 | 865921 | 878852 | Rajasthan |
| 17. | Kangayam | 314817 | 80260 | 127577 | Tamil Nadu | 42. | Red Kandhari | 176621 | 235058 | 95304 | Maharashtra |
| 18. | Kankrej | 3884457 | 1945094 | 1580802 | Gujarat Rajasthan | 43. | Red Sindhi | 550272 | 59642 | 272850 | Organized farms only |
| 19. | Kenkatha | 179987 | 393291 | 76663 | Uttar Pradesh Madhya Pradesh | 44. | Sahiwal | 457177 | 1092459 | 1881453 | Punjab Rajasthan |
| 20. | Khariar | - | 290015 | 13365 | Odisha | 45. | Shweta Kapila | - | - | - | Goa |
| 21. | Kherigarh | 171414 | 75116 | 28433 | Uttar Pradesh | 46. | Siri | 61750 | 12171 | 15278 | Sikkim West Bengal |
| 22. | Khillar | 1419735 | 1102359 | 844400 | Maharashtra Karnataka | 47. | Tharparkar | 557621 | 197291 | 151056 | Rajasthan |
| 23. | Kosali | - | 2431859 | 989803 | Chhattisgarh | 48. | Thutho | - | - | - | Nagaland |
| 24. | Konkan Kapila | - | - | 989803 | Chhattisgarh | 49. | Umblachery | 217960 | 39050 | 31195 | Tamil Nadu |
| 25. | Krishna Valley | 2314 | 3462 | 2594 | Maharashtra Karnataka | 50. | Vechur | 160 | 1075 | 8963 | Kerla |
| **Buffalo breeds** | | | | | | | | | | | |
| 1. | Bargur | - | - | - | Tamilnadu | 11. | Manda | - | - | - | Odisha |

| S. N. | Breed | Population (2007) | Population (2013) | Population (2022) | State(s) | S. N. | Breed | Population (2007) | Population (2013) | Population (2022) | State(s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2. | Banni | 525099 | 239572 | 512851 | Gujarat | 12. | Marathwadi | 181712 | 278502 | 217581 | Maharashtra |
| 3. | Bhadawari | 723516 | 583599 | 1065485 | Uttar Pradesh, Madhya Pradesh, | 13. | Murrah | 20488,488 | 11686198 | 14246525 | All India |
| 4. | Chhattisgarhi | - | - | - | Chhattisgarh | 14. | Mehsana | 3373006 | 1676699 | 3442006 | Gujarat |
| 5. | Chilika | 1001 | 2599 | 11010 | Odisha | 15. | Nagpuri | 139939 | 73584 | 104016 | Maharashtra |
| 6. | Dharwadi | - | - | - | Karnataka | 16. | Nili ravi | 591001 | 129411 | 108659 | Punjab, Haryana, |
| 7. | Gojri | - | - | - | Punjab and Himachal Pradesh | 17. | Pandharpuri | 272122 | 287751 | 376182 | Maharashtra |
| 8. | Jaffarabadi | 1843727 | 571077 | 1113789 | Gujarat, Maharashtra, | 18. | Surti | 2982514 | 1886280 | 1122735 | Gujarat, Rajasthan, |
| 9. | Kalahandi | 146052 | 115213 | 18123 | Odisha | 19. | Toda | 50404 | 3003 | 14497 | Tamil Nadu |
| 10. | Luit (Swamp) | - | - | - | Assam and Manipur | | | | | | |

red coat colour are Gir, Motu, Rathi, Red Kandhari, Red Sindhi and Sahiwal. The Rathi breed had white spots or patches on brownish red coat. Purnea cattle are available in red and white/grey coat colours. Dangi, Ponwar and Siri cattle possess black/white patches on their body. Dangi, Bargur and Nimari had red/white patches on their coat. Calves of Umblachery have red or brown coat colour at birth. Red/brown colour begins to change to grey at the age of 3-4 months and get completely grey colour at 6-8 months of age. Breeds found in hilly tracts like hill cattle of Uttarakhand (Badri) and Himachal Pradesh (Himachali Pahari) and indigenous cattle like Thutho Nagaland, Lakhimi of Assam, Malnad Gidda of Karnataka and Vechur of Kerala are found in multiple coat colours of black, red, brown, white and even fawn/ golden (Pundir and Sharma, 2016).

Based on size of the body Vechur, Malnad Gidda, Punganur, Motu, Purnea, Kosali and Hill cattle are known as small type. The breeds Bachaur, Bargur, Binjharpuri, Dangi, Gaolao, Ghumsuri, Tho-Tho, Pullikulam, Kenkatha, Khariar, Krishna Valley, Nimari, Rathi, Siri, Umblachery, and Kherigarh are of medium size. The large size breeds include Ongole, Gir, Hariana, Deoni, Mewati, Nagori, Tharparkar, Kankrej, Malvi, Kangayam, Red Sindhi, Sahiwal, Khillar, Hallikar, Amritmahal, Gangatiri (Pundir and Sharma, 2016).

Based on horn size Kankrej had the thickest horns. Long horns were available in Hallikar, Bargur, Khillar, Pullikulam, Kangayam, Amritmahal, Krishna Valley breeds. The short type horns breeds are Hariana, Siri, Rathi, Ongole, Bachaur, Nagori, Gaolao, Mewati, Krishna Valley, Ponwar, Binjharpuri and Gangatiri.

The trends in percent in different cattle breeds population during 2013-2022 are presented in Fig. 2 and 3. There are 15 breeds showing increasing trends. The maximum increase was observed in Vechur breed followed by Red Sindhi, Bachur and Punganaur. Rathi breed has shown smallest increasing trend as 1.49% over the same period. There are 22 breeds showing declining trends in their populations during the years 2013-2022. The maximum decline was observed in Khariar breed followed by Kenkatha, Red Kandhari and Kherigarh. Amritmahal breed showing almost static population over the same period.

The crossbred/exotic cattle are distributed in larger area of the country. The main breeds in this category include Holstein Friesian and Jersey, however, exotic as well as crossbreds of some other breeds like Brown Swiss have also been reported though comparatively less in number. Some of the synthetic strains/breeds have been developed by using exotic germplasm. These include Frieswal, Karan Swiss, Karan Fries, Sunandini, Vrindavani, Taylor, Jersindh etc.

## Buffalo Diversity

Two types of buffaloes are recognized based on their phenotypes and karyotypes i.e. the river/water buffalo (2N=50) found in Indian subcontinent, in Middle-East

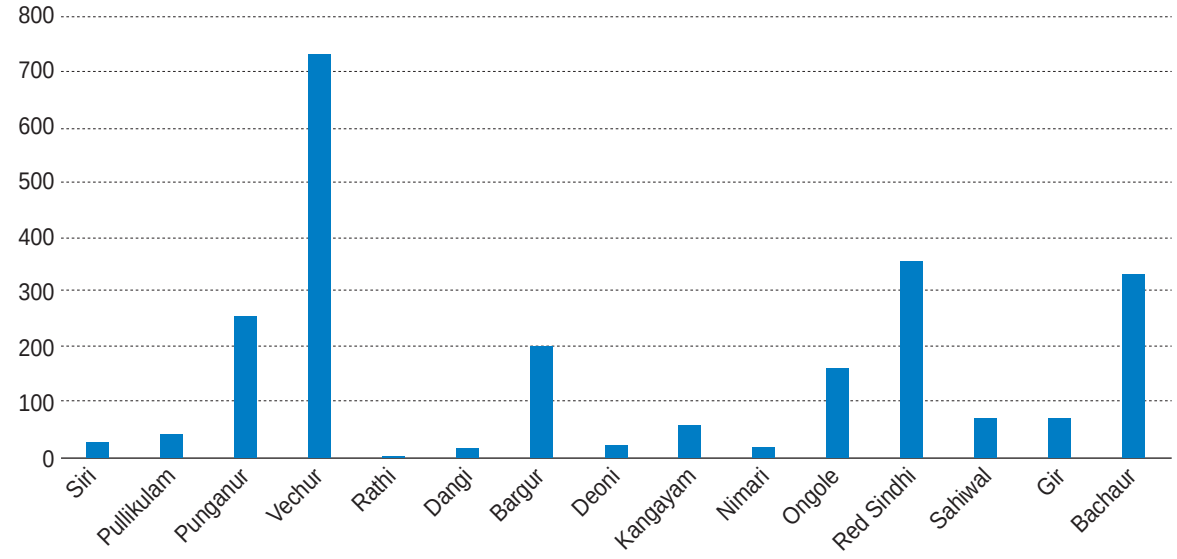


**Fig. 2. Cattle breeds showing increasing trends during the years 2013-2022**

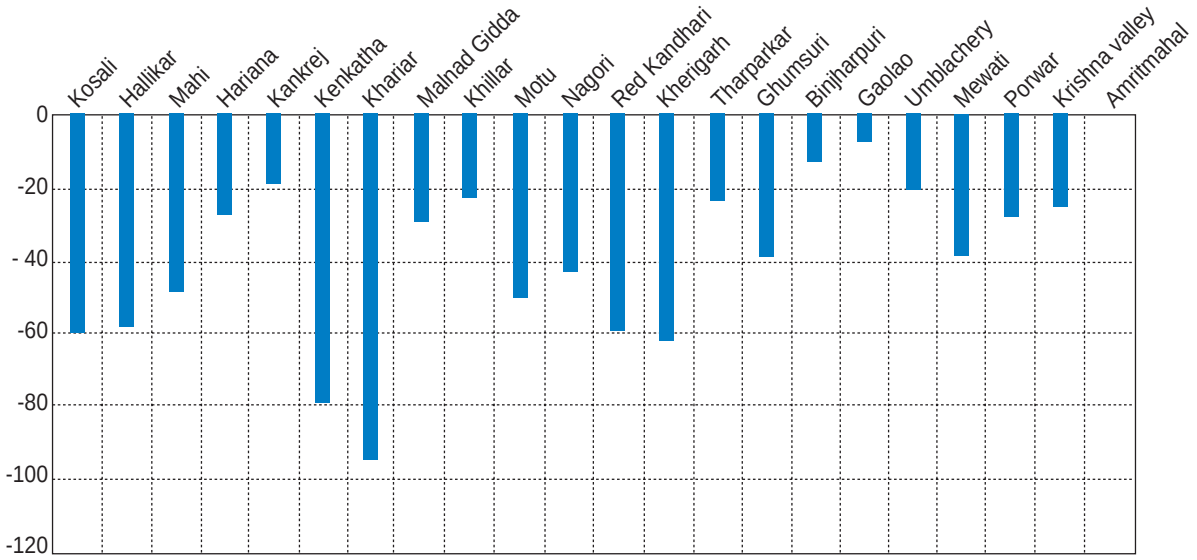


**Fig. 3. Cattle breeds showing decreasing trends during the years 2013-2022**

and Eastern Europe especially Italy and Bulgaria and the swamp buffalo (2N=48) found in China and South-East Asian countries. These two subspecies were originated and domesticated independently, the river/water buffalo in the Indus valley and /or Euphrates and Tigris valley some 5000 years back, and the swamp buffalo in China where it was domesticated at least 4000 years ago in association with the emergence of rice cultivation. In spite the two subspecies are cytogenetically different but do hybridize among themselves, but the hybrids (2N=49) produced have relatively low fertility or infertile.

Buffalo breeds, their distribution and population over different years are presented in Table-1.There are 19 registered breeds of buffalo in the country and can be classified into six major groups as follows.

(i) Murrah group comprises Murrah, Nili-Ravi and Gojri which have the home tract in Haryana and Punjab, respectively. Gojri has the ability to graze on hill tops and has characteristic “Pattiah wale seengh”.

(ii) Gujarat group comprising Jaffarabadi, Surti, Mehsana and Banni from Gujarat.

(iii) Uttar Pradesh group has Bhadawari.

(iv) Central India group includes Nagpuri and Pandharpuri breed in Maharashtra, Kalahandi, Manda and Chilika in Odisha, Chhattisgarhi buffalo from Chhattisgarh.

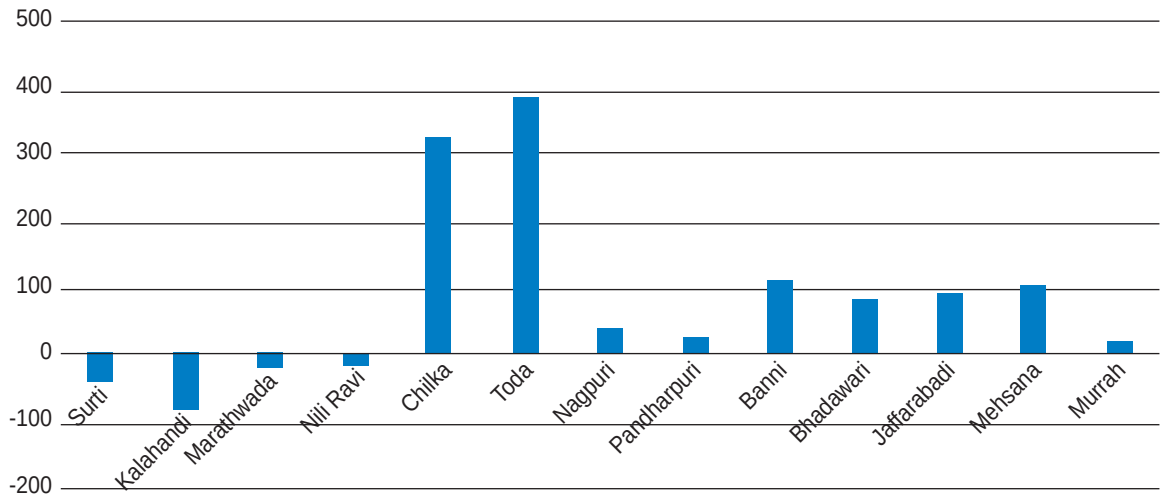


**Fig. 4. Buffalo breeds showing trends during the years 2013-2022**

(v) South India group comprises Toda and Bargur buffalo in Tamilnadu, Dharwadi in Karnataka.

(iv) North-Eastern group includes Luit and Swamp buffaloes mainly available in Assam.

The large size buffaloes include Murrah, Nili-Ravi and Jaffarabadi, medium sized are Mehsana, Marathwada, Nagpuri, Pandharpuri, Bhadawari, Surti and Toda. Swamp buffaloes are available in north-east states of the country. India possesses the best milch buffalo breeds of the world like Murrah, Nili Ravi and Jaffarabadi. Bhadawari breed is famous for high fat percentage in milk. Surti is the smallest size buffalo available in the country. Buffaloes are also used for work and meat production. There are several breeds in India which have regional importance and add to economic value of the farming community viz. Bhadawari and Tarai in Uttar Pradesh, Nagpuri and Pandharpuri in Maharashtra; Parlakhemundi, Manda, Jerangi, Kalahandi, Sambalpur in Orissa and Andhra Pradesh, Toda in Tamil Nadu and South Kanara in Karnataka and Kerala. Mehsana breed has been developed from grading up of Surti buffaloes with Murrah in north Gujarat. Similarly continued grading up of local non-descript buffaloes with Murrah breed in Krishna and Godawari District of Andhra Pradesh has resulted into a strain popularly known as Godavari (Pundir and Sharma, 2016).

All the buffalo breeds can be divided in to two categories based on their coat colous black (Murrah, Mehsana, Banni and Niliravi) and grey (Suri, Toda and Chilka). Based on body size they can be further divided in to 3 different categories like large ( Jafarabadi, Murrah and Banni), medium size (Bhadawari, Marathawada and Pandharpuri) and small (Surti and Chilka). Based on horn patterns buffalo breeds can be divided in to four different categories like short and tightly curved (Murrah, Banni and Mehsana), large but downward (Jafarabadi, Marathawada and Nagpuri), medium (Bhadawari) and large upward (Toda and Chilka).

Among the 13 breeds of buffalo included breed census, 4 are showing declining trends during the 2013-2022 i.e. Surti, Kalahandi, Marathawadi and Niliravi. Maximum declining trends was observed in Kalahandi buffalo. Chilka and Toda breeds has shown more than 300% increase in their population. Murrah breed is showing an increase of 21.91% in their population during the same period.

## Strategies for Improving Bovines

For improving of indigenous cattle and buffalo following strategies may be adopted.

- Characterization of non-descript population and their registration as distinct breed, if eligible.
- Livestock Census may be conducted breed wise accurately which will help in formulation of appropriate breeding strategies for genetic improvement programs.
- Establish /strengthening of nucleus breeding farms for all registered breeds in the respective breeding tract to produce superior germplasm for breeding.
- Performance recording may be imitated in field/ farmer herds.

- Increasing the AI coverage in field conditions.
- Genetic improvement through Open Nucleus Breeding System (ONBS) and Progeny Testing of bulls.
- Multiplication of elite germplasm by different reproductive technologies like cloning, embryo transfer etc.
- Value addition of different bovine products.
- Creation of awareness in masses for uniqueness of indigenous bovine germplasm.
- Efforts should be made for conservation, those breed needed conservation.
- Establishing *ex situ* and *in situ* conservation units in respective breeding tracts for those breeds needed conservation
- Somatic cells at National Gene Bank for repository.
- Establishment of breed society for all registered breed.

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