

Review paper
Population trends and distribution of indigenous sheep in India

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ABSTRACT

The Indigenous sheep are rich in variability and are endowed with many positive traits like superior disease resistance, high prolificacy and better tolerance to heat/humidity and feed scarcity etc. The present status of indigenous sheep was evaluated in terms of the population trend and their distribution at state and district level. It is estimated that population of indigenous sheep will increase to 79.654 million by 2031. Only four states of Telangana, Andhra Pradesh, Karnataka and Rajasthan account for the 76.7 and 74.9 percent of the indigenous and total sheep population of India. The region comprising only six districts of Anantapur, Prakasam, Kurnool, YSR, Chittoor and SPSR in the state of Andhra Pradesh possesses 18.6 percent of the indigenous sheep population of the country. Anantapur district of Andhra Pradesh has the largest population of indigenous (4.655 million) and total (4.927 million) sheep, while, Wanaparthy district of Telangana has highest density per km² and per 1000 households for indigenous (453.4 and 7898.1) and total (453.9 and 7906.8) sheep, respectively. During 2007-2012, the population of indigenous sheep registered a decline of 9.64 percent, but the rate of decline in the population of recognized breeds (21.9 percent) was more than twice as fast during the same period.

Key words: Sheep, Animal Genetic Resources, Population trend

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INTRODUCTION

India's sheep population with 70.172 million heads is the third largest after China and Australia (BAHS 2006). They convert sparse vegetation growing on uncultivable lands into high quality meat, wool, hide and manure. The indigenous sheep are primarily maintained for meat and carpet wool, although a few are also reared for apparel wool (Acharya 1982). Indian sheep possess unique qualities in terms of meat, wool and prolificacy (Jain *et al.* 2005, Shinde and Sejian 2013, Davis *et al.* 2002). The ovine genetic resources of India are maintained under diverse agro-climatic conditions, therefore, their phenotype and outputs are equally diverse. This paper attempts to describe the present status of sheep in India in terms of their population trends and distribution with special emphasis on indigenous sheep.

MATERIALS AND METHODS

The data on sheep population were obtained from Livestock census (Livestock census 2007, 2012, and 2019) and state and district wise population densities per km² and per 1000 households were calculated. The state and district wise census data for indigenous and exotic/crossbred sheep was grouped for population intervals to obtain the number of states or districts with specified minimum population. The regression equation for the population trend was developed (Gupta 2011) using census data from 1992

onwards and the population for the years 2023, 2027 and 2031 were estimated by method modified from (Singh *et al.* 1991) as

$$Y' = a + bX'$$

Where, Y' = Estimated population in the year X'

b = Slope in the regression equation Y = a + bX

a = Y, when X = 0

Data for individual breeds was obtained from Livestock census (2007) and Breed survey (2013) estimate that is derived by disintegrating the figures of Livestock census (2012). The Andhra Pradesh and Jammu & Kashmir refer to present day state/union territory until unless specified.

RESULTS AND DISCUSSION

Sheep husbandry is a vital and important agricultural activity from temperate to tropical ecology of India characterized by feed scarcity, marginal land and poor economic conditions of sheep farmers (Mishra and Kumar 2012). The Indigenous sheep are richly diverse in their phenotype and adaptation and are endowed with many positive traits like prolificacy (Davis *et al.* 2002, Kumar *et al.* 2008, Sudhakar *et al.* 2013, Mishra *et al.* 2018) superior disease resistance (Yadav *et al.* 1993, Swarnkar *et al.* 1997, Sanyal 1988, Nimbkar *et al.* 2003, Swarnkar and Singh 2012, Singh and Swarnkar 2014), better tolerance to high heat and humidity (Maurya *et al.* 1998, Karim and Shinde 2007, Sejian *et al.* 2010, Sejian

et al. 2013). The population of indigenous sheep has registered an increase of 45.07 percent from 1992 (48.372 million) to 2019 (70.172 million). Considering this trend, the population of indigenous sheep is estimated to increase to 73.532, 76.593 and 79.654 million in the years 2023, 2027 and 2031, respectively. Similar trend is also reflected for the total sheep population of the country. It stood at 74.261 million in 2019, showing an increase of 46.23 percent from their population (50.783 million) in 1992. The total sheep population is also estimated to increase to 78.138, 81.375 and 84.612 million in the years 2023, 2027 and 2031, respectively (Table 1). During 2007-2019, the population of indigenous sheep has shown a meagre increase of only 3.46 percent compared to 9.61 percent increase in exotic/crossbred sheep.

During 1992-2019, the population of exotic and crossbred (CB) sheep has increased from 2.411 million to 4.088 million. Although, the population of exotic/CB sheep is much less compared to indigenous sheep, but it registered a much higher increase of 69.55 percent during 1992-2019 compared to 45.07 increase in indigenous sheep during the same period. The population of exotic/CB sheep is estimated to increase to 4.606, 4.782 and 4.957 million in the years 2023, 2027 and 2031, respectively.

Among states and union territories (UTs) of India, the indigenous sheep population is more than 10 million in three states (Telangana, Andhra Pradesh and Karnataka), between 1-10 million in six states/UTs (Rajasthan, Tamil Nadu, Maharashtra, Gujarat, Jammu & Kashmir and Odisha) and between 0.1-1 million in nine states/UTs (West Bengal, Uttar Pradesh, Himachal Pradesh, Jharkhand, Assam, Madhya Pradesh, Haryana, Uttarakhand, Bihar, Ladakh and Chhattisgarh) (Table 2). As in most of the states and UTs the indigenous sheep population constitutes more than 90 percent of the total sheep, the trend in indigenous sheep reflects the overall status of the sheep population except Jammu & Kashmir, Uttarakhand and Punjab that have only 48.55, 73.17 and 86.11 percent sheep of indigenous type.

Telangana has the largest population (19.063 million) of indigenous sheep, possessing about 26.47 percent of the total indigenous sheep population of the country followed by Andhra Pradesh (16.445 million), Karnataka (10.950 million) and Rajasthan (7.856

million) (Livestock census 2019). These four states of Telangana, Andhra Pradesh, Karnataka and Rajasthan hold the 76.7 and 74.9 percent of the indigenous and total sheep population of India. They along with Tamil Nadu, Maharashtra, Gujarat and Jammu & Kashmir hold the 91.02 and 91.11 percent of the indigenous and total sheep population of India. In population density per km² also, Telangana has highest density of indigenous sheep (165.74) followed by Andhra Pradesh (102.66), Karnataka (57.10) and Jammu & Kashmir (35.05). The density (sheep per km²) of indigenous sheep is more than 100 only in two states (Telangana and Andhra Pradesh), between 50-100 in one state (Karnataka) and between 10-50 in five states (Jammu & Kashmir, Tamil Nadu, Rajasthan, Himachal Pradesh and West Bengal). In these states, similar trend is observed for total sheep density except Jammu & Kashmir that has overall sheep density of 72.18 per km². In terms of density per 1000 households Ladakh (4549.71) has the highest density of indigenous sheep followed by Telangana (2222.60), Andhra Pradesh (1298.59) and Karnataka (819.83) (Table 2 and 3).

As regards exotic/CB sheep, Jammu & Kashmir holds the largest population and highest density per km² (1.569 million, 37.14) followed by Andhra Pradesh (1.186 million, 7.37), Telangana (0.487 million, 4.34) and Tamil Nadu (0.278 lakhs, 2.13). In terms of density per 1000 households Jammu & Kashmir (754.35) has the highest density followed by Ladakh (382.36), Andhra Pradesh (93.22) and Telangana (58.26).

Among states and UTs with total sheep population of at least 20000, Jharkhand has the highest percentage of indigenous sheep (99.79) followed by Gujarat (99.73), Chhattisgarh (99.68) and Odisha (99.49). Jammu & Kashmir has the lowest proportion of indigenous sheep (48.55) followed by Uttarakhand (73.17), Punjab (86.11) and Himachal Pradesh (90.80) (Table 3). Among these states and UTs, eleven states/UTs (Telangana, Andhra Pradesh, Karnataka, Maharashtra, Gujarat, Jammu & Kashmir, Himachal Pradesh, Jharkhand, Madhya Pradesh, Ladakh and Chhattisgarh) have shown an increase in the population of indigenous sheep during 2012-2019. However, during 2007-2019, only five states, *viz* Jharkhand (33.15%), Chhattisgarh (28.65), Karnataka (14.78), Uttarakhand (2.65) and Himachal Pradesh (2.42) have shown increase in indigenous sheep population. Whereas, the maximum decline in indigenous sheep was observed in the state of

Punjab (60.22 %) followed by Haryana (53.53), Tamil Nadu (56.54) and West Bengal (40.17) during this period (Table 1). In case of exotic/CB sheep, undivided Andhra Pradesh has registered maximum increase of 74 fold

followed by Odisha (62 fold), Maharashtra (11.6 fold) and Karnataka (5.5 fold) during this period. Only three states (Karnataka, Jharkhand and Chhattisgarh) have shown increase in total sheep population during this period.

Table 1: Population trend of sheep in India

Census-year	Indigenous sheep		Exotic and crossbred sheep		Total sheep	
	Population (in million)	Percent change from previous census	Population (in million)	Percent change from previous census	Population (in million)	Percent change from previous census
1992	48.372		2.411		50.783	
1997	54.384	12.43	3.110	28.99	57.494	13.22
2003	55.741	2.50	5.729	84.21	61.469	6.91
2007	67.829	21.69	3.730	-34.90	71.558	16.41
2012	61.288	-9.64	3.781	1.38	65.069	-9.07
2019	70.172	14.50	4.088	8.12	74.261	14.13
2023 (Estimated)	73.532	-	4.606	-	78.138	-
2027 (Estimated)	76.593	-	4.782	-	81.375	-
2031 (Estimated)	79.654	-	4.957	-	84.612	-

During this period (2007-2019), the states of Andhra Pradesh and Telangana that hold 49.9 percent of the indigenous sheep population of India, have shown a decline of 35.56 percent in indigenous sheep and a 74 fold increase in exotic sheep population. Rajasthan, Tamil Nadu and Maharashtra that hold 11.19, 6.02 and 3.64 percent of the indigenous sheep population of

India, have registered a decline of 29.45, 41.64 and 11.84 percent in the indigenous sheep population during this period, respectively. Among the major sheep rearing states only Karnataka, that holds 15.61 percent of indigenous sheep of India, has shown an increase of 14.78 percent in indigenous sheep population during this period (Table 2 and 3).

Table 2: Total population and percent change during 2012-2019 and 2007-2019 of sheep in the states of India with sizable sheep population

State	Population	Percent change	Indigenous	Exotic Indig.	Total Exotic	2012-2019		2007-2019	
						Total	Indig.	Exotic	Total
Telangana@	18576107a	486951c	19063058a	44.96	1004.20	48.25	\$	\$	\$
Andhra Pradesh@	16446345b	1180626b	17626971b	21.58	12678.72	30.22	-35.56#	7321.12#	-30.98#
Karnataka	10950465c	100263	11050728c	14.74	148.92	15.31	14.78	46.84	15.61
Rajasthan	7855551d	48306	7903857d	-12.61	-46.95	-12.95	-29.45	-1.36	-29.37
Tamil Nadu	4222841e	277650d	4500491e	-1.53	-44.28	-5.98	-41.64	-3.21	-43.68
Maharashtra	2555512	124817e	2680329	1.86	74.27	3.87	-11.84	064.77	-7.87
Gujarat	1782400	4863	1787263	5.99	-81.36	4.66	-10.32	-65.51	-10.71
J & K (UT)@	1480356	1568646a	3049002	64.51	-30.58	-3.50	-0.65#	-35.42#	-21.31#
Odisha	1272660	6489	1279149	-18.97	-38.82	-19.10	-30.00	6139.42	-29.65
West Bengal	936798	16088	952886	-10.89	-35.07	-11.45	-40.17	41.74	-39.58
Uttar Pradesh	933639	51086	984725	-26.58	-37.76	-27.25	-19.19	58.74	-17.08
Himachal Pradesh	718524	72821	791345	43.80	-76.14	-1.68	2.42	-63.55	-12.20
Jharkhand	639852	1331	641183	11.37	-84.12	9.99	33.15	-52.33	32.66
Assam	325291	6809	332100	-36.04	-28.23	-35.90	-7.53	236.08	-6.13
Madhya Pradesh	319982	4603	324585	8.45	-66.88	5.06	-16.27	-40.31	-16.74
Haryana	268317	20053	288370	-13.70	-61.21	-20.48	-53.53	-16.25	-52.05
Uttarakhand	208256	76359	284615	-13.68	-40.11	-22.82	2.65	-12.77	-2.00
Bihar	204248	9129	213377	-8.54	-0.19	-8.21	-1.66	-13.37	-2.23
Ladakh (UT)@	183112	15389	198501	5.13	-72.43	-13.69	\$	\$	\$
Chhattisgarh	179648	581	180229	7.95	-67.78	7.14	28.65	13.04	28.59
Punjab	73673	11887	85560	-25.53	-59.85	-33.43	-60.22	-48.17	-58.89
Others*	38905	3386	42291	-20.21	-68.58	-28.97	-40.23	-52.63	-41.46
India	70172482	4088133	74260615	14.50	8.12	14.13	3.46	9.61	3.78

*States with total sheep population of <20000

^aFirst, ^bsecond, ^cthird, ^dfourth and ^efifth highest value under the respective column heading.

⁶Population for Jammu & Kashmir, Ladakh for 2012 and 2019 and for Telangana, and Andhra Pradesh for 2012 calculated from district-wise population available in respective Livestock census.

⁷Population data not available for Telangana in 2007 census. ⁸Percentage change for combined Andhra Pradesh-Telangana and Jammu & Kashmir-Ladakh.

Table 3: Percent of indigenous in total sheep, descript in indigenous sheep, population density per km² and per 1000 households and proportion in total population of India of indigenous, exotic/CB and total sheep in states/UTs with sizable sheep population

State*	Percent of indigenous in total sheep	\$Percent of descript in indigenous sheep (Breed survey, 2013)	Indigenous			Exotic/crossbred			Total sheep		
			Density		Percent of state of total indigenous sheep of India	Density		Percent of state of total exotic/CB sheep of India	Density		Percent of state of total sheep of India
			per km2	Per 1000 households		per km2	Per 1000 households		per km2	Per 1000 households	
Telangana	97.45	–	165.74a	2222.60b	26.47a	4.34c	58.26d	11.91c	170.09a	2280.86b	25.67
Andhra Pradesh	93.30	35.60\$	102.66b	1298.59c	23.44b	7.37b	93.22c	28.88b	110.03b	1391.81d	23.74
Karnataka	99.09	34.97	57.10c	819.83d	15.61c	0.52	7.51	2.45	57.62d		
	827.33e	14.88									
Rajasthan	99.39e	52.17	22.95	618.00	11.19d	0.14	3.80	1.18	23.09		
	621.81	10.64									
Tamil Nadu	93.83	55.07	32.47e	227.95	6.02e	2.13d	14.99	6.79d	34.60e		
	242.94	6.06									
Maharashtra	95.34	34.83	8.30	104.64	3.64	0.41	5.11	3.05e	8.71		
	109.75	3.61									
Gujarat	99.73b	64.08	9.08	145.52	2.54	0.02	0.40	0.12	9.11		
	145.92	2.41									
J & K (UT)	48.55	22.53\$	35.05d	711.89e	2.11	37.14a	754.35a	38.37a	72.18c	1466.24c	4.11
Odisha	99.49d	21.33	8.17	132.05	1.81	0.04	0.67	0.16	8.22	132.72	1.72
West Bengal	98.31	69.25	10.56	45.97	1.33	0.18	0.79	0.39	10.74	46.76	1.28
Uttar Pradesh	94.81	18.35	3.88	27.91	1.33	0.21	1.53	1.25	4.09	29.44	1.33
Himachal Pradesh	90.80	38.40	12.91	484.42	1.02	1.31	49.09e	1.78	14.21	533.51	1.07
Jharkhand	99.79a	36.73	8.03	102.30	0.91	0.02	0.21	0.03	8.04	102.51	0.86
Assam	97.95	0.00	4.15	50.78	0.46	0.09	1.06	0.17	4.23	51.84	0.45
Madhya Pradesh	98.58	0.27	1.04	21.20	0.46	0.01	0.30	0.11	1.05	21.51	0.44
Haryana	93.05	6.61	6.07	55.24	0.38	0.45	4.13	0.49	6.52	59.37	0.39
Uttarakhand	73.17	10.75	3.89	101.24	0.30	1.43e	37.12	1.87	4.09	138.37	0.38
Bihar	95.72	19.93	2.17	10.80	0.29	0.10	0.48	0.22	2.27	11.28	0.29
Ladakh (UT)	92.25	–	3.10	4549.71a	0.26	0.26	382.36b	0.38	3.36	4932.07a	0.27
Chhattisgarh	99.68c	0.00	1.33	31.79	0.26	0.00	0.10	0.01	1.33	31.89	0.24
Punjab	86.11	30.56	1.46	13.36	0.10	0.24	2.16	0.29	1.70	15.52	0.12
India	94.49	38.81	21.35	281.30	100.00	1.24	16.39	100.00	22.59	297.69	100.0

*First, ^bsecond, ^cthird, ^dfourth and ^efifth highest value under the respective column heading; ⁸Values for undivided Andhra Pradesh and Jammu & Kashmir

In the eighteen states in India that have more than 0.5 million indigenous sheep, some cluster of districts have high density of the indigenous sheep. For example, Cluster-I in Andhra Pradesh comprising six Southern districts of Anantapur, Prakasam, Kurnool, YSR, Chittoor and SPSR has 79.5 and 18.6 percent of the indigenous sheep population of the state and the country, respectively, with a density per km² and per 1000 households of 133.4 and 2495.8, respectively. Similarly, eight Southern districts (Rangareddi, Nalgonda, Mahbubnagar, Wanaparthy, Nagarkurnool, Jogulamba-Gadwal, Medchal-Malkajgiri, Yadadri-Bhuvanagiri) of cluster-I of Telangana hold 39.4 and 10.4 percent population of indigenous sheep of the state and the

country, respectively with a density per km² and per 1000 households of 216.2 and 2920.9, respectively. Cluster-I in Karnataka comprising six districts of Chitradurga, Tumakuru, Bellary, Koppal, Chikballapur and Kollar, bordering Andhra Pradesh, has 48.6 and 7.6 percent indigenous sheep population of the state and the country, respectively, with a density per km² and per 1000 households of 129.0 and 2248.7, respectively. Likewise, Cluster-I in Rajasthan comprising eight Western arid districts of Barmer, Jaisalmer, Pali, Bikaner, Jodhpur, Nagaur, Jalore, Sirohi, has 62.4 and 7.0 percent indigenous sheep population of the state and the country, respectively, with a density per km² and per 1000 households of 29.6 and 1568.1, respectively (Table 4).

Table 4: Clusters of districts holding major proportion of population of indigenous sheep in the states of India with more than 0.5 million indigenous sheep

State*	Clusters of districts with sizable population of indigenous sheep
Telangana	Cluster I: Rangareddi, Nalgonda, Mahbubnagar, Wanaparthy, Nagarkurnool, Jogulamba-Gadwal, Medchal-Malkajgiri, Yadadri-Bhuvanagiri (7315169a, 216.2.0b, 2920.9c, 39.4d, 10.4e) Cluster II: Jangoan, Siddipet, Karimnagar, Peddapalli, Jagitial, Mancheria (3666938, 220.6, 2814.5, 19.7, 5.2) Cluster III: Suryapet, Khammam, Mahabubabad, Warangal-rural, Warangal-urban (3214696, 224.3, 2433.1, 17.31, 4.58) Cluster IV: Nirmal, Nizamabad, Kamareddy, Medak (2395369, 164.2, 2586.8, 12.9, 3.4)
Andhra Pradesh	Cluster I: Anantapur, Prakasam, Kurnool, YSR, Chittoor, SPSR-Nellore (13076126, 133.4, 2495.8, 79.5, 18.6)
Karnataka	Cluster I: Chitradurga, Tumakuru, Bellary, Koppal, Chikballapur, Kolar (5326751, 129.0, 2248.7, 48.6, 7.6)
Rajasthan	Cluster I: Barmer, Jaisalmer, Pali, Bikaner, Jodhpur, Nagaur, Jalore, Sirohi (4904378, 29.6, 1568.1, 62.4, 7.0)
Tamil Nadu	Cluster I: Virudhunagar, Ramanathapuram, Thoothukkudi, Madurai, Sivaganga, Pudukkottai, Tirunelveli (1468775, 45.4, 401.2, 34.8, 2.1) Cluster II: Salem, Erode, Tiruppur, Namakkal, Karur, Tiruchirappalli (1318378, 48.8, 351.8, 31.2, 1.9) Cluster III: Krishnagiri, Vellore, Tiruvannamalai, Kanchipuram (675708, 30.9, 22.7, 16.0, 0.96)
Maharashtra	Cluster I: Dhule, Ahmednagar, Nashik (977968, 24.6, 381.8, 38.3, 1.4) Cluster II: Pune, Satara, Sangli, Solapur, Kolhapur (766761, 13.4, 149.8, 30.0, 1.1)
Gujarat	Cluster I: Kachchh, Banaskantha, Sabarkantha, Patan, Gandhinagar, Arvali (871798, 12.2, 426.3, 48.9, 1.2) Cluster II: Jamnagar, Bhavnagar, Rajkot, Amreli, Devbhumi-Dwarka, Surendranagar, Junagadh, Porbandar, Morbi, Gir-Somnath (816374, 13.0, 279.3, 45.8, 1.2)
Jammu & Kashmir	Cluster I: Doda, Kathua, Rajauri, Kishtwar, Poonch, Reasi, Udhampur, Ramban, Samba, Jammu (1162420, 44.2, 1100.7 78.5, 1.7)
Odisha	Cluster I: Kalahandi, Nabarangpur, Koraput (312426, 14.2, 308.6, 24.6, 0.5) Cluster II: Bargarh, Sonapur, Boudh, Balangir (261862, 14.7, 251.0, 20.6, 0.4) Cluster III: Ganjam, Nayagarh (200243, 16.6, 203.0, 15.7, 0.3)
West Bengal	Cluster I: Purulia, Birbhum, Bardhaman-East, Bankura (548154, 23.7, 150.8, 58.5, 0.8)
Uttar Pradesh	Cluster I: Allahabad, Fatehpur, Mirzapur, Kaushambi, Sant-Ravidas-Nagar (315477, 18.7, 134.6, 33.8, 0.5)
Himachal Pradesh	Cluster I: Chamba, Kangra, Mandi, Kullu, Shimla, Kinnaur (683407, 20.6, 712.2, 95.2, 1.0)
Jharkhand	Cluster I: West-Singbhum, East-Singbhum, Saraikela-Kharsawan, Khunti (314609, 19.1, 285.0, 49.2, 0.5)

Some cluster of districts also have exceptionally high population of exotic/CB sheep. For example, Cluster I of Jammu & Kashmir comprising nine districts of Kashmir valley (Shopian, Kulgam, Ganderbal, Badgam, Pulwama, Bandipora, Anantnag, Baramulla and Kupwara) hold 57.9 and 22.2 percent population of exotic/crossbred sheep of the state and the country, respectively with a density per km² and per 1000 households of 65.0 and 1092.5, respectively. Many of

the clusters that have high density of indigenous sheep, now have the exotic/CB sheep population. For example, cluster I of Andhra Pradesh comprising five Southern districts of Andhra Pradesh (Anantapur, Chittoor, YSR, Kurnool, SPSR-Nellore) hold 63.7 and 18.4 percent population of exotic/CB sheep of the state and the country, respectively with a density per km² and per 1000 households of 9.3 and 171.6, respectively (Table 5).

Table 5: Clusters of districts holding major proportion of exotic/CB sheep in the states of India with sizable number of exotic/CB sheep

State	Clusters of districts with sizable population of exotic/CB sheep
Jammu & Kashmir	Cluster I: Shopian, Kulgam, Ganderbal, Badgam, Pulwama, Bandipora, Anantnag, Baramulla, Kupwara (908606a, 65.0b, 1092.5c, 57.9d, 22.2e) Cluster II: Udhampur, Rajauri, Kathua, Reasi, Doda, Kishtwar, Poonch, Jammu, Ramban, Samba (643269, 24.5, 609.1, 41.0, 15.7)
Andhra Pradesh	Cluster I: Anantapur, Chittoor, YSR, Kurnool, SPSR-Nellore (751471, 9.3, 171.6, 63.7, 18.4) Cluster II: Srikakulam, Vizianagaram (214986, 17.4, 169.5, 18.2, 5.3)
Telangana	Cluster I: Nizamabad, Rajanna-Sircilla, Karimnagar, Peddapalli, Siddipet, Warangal-urban (179933, 11.5, 121.6, 37.0, 4.4) Cluster II: Mahbubnagar, Rangareddi, Yadadri-Bhuvanagiri (142965, 10.5, 135.8, 29.4, 3.5)
Tamil Nadu	Cluster I: Krishnagiri, Vellore, Thiruvallur, Tiruvannamalai, Villupuram (107309, 3.8, 28.9, 38.7, 2.6) Cluster II: Dindigul, Karur (33338, 3.7, 39.3, 12.0, 0.8)
Maharashtra	Cluster I: Pune, Nashik, Ahmednagar (79127, 1.6, 18.4, 63.4, 1.9)
Karnataka	Cluster I: Gadag, Bellary (42589, 3.2, 60.1, 42.5, 1.0) Cluster II: Chikballapur, Bengaluru-U, Bengaluru-R (26560, 3.0, 9.1, 26.5, 0.7)
Uttarakhand	Cluster I: Uttarkashi, Tehri-Garhwal (61712, 5.3, 308.1, 80.8, 1.5)

^aTotal population in the cluster, ^bdensity per km², ^cdensity per 1000 households, ^dproportion of state population and ^eproportion of national population of exotic/crossbred sheep

Some districts have appreciably high population of indigenous sheep. Anathapur district of Andhra Pradesh has the highest population (4.655 million)) of indigenous sheep followed by Mahabubnagar (2.253 million) of Telangana and Prakasam (1.978 million) and Kurnool (1.916 million) of Andhra Pradesh. These districts also hold the largest population of total sheep

also. Anantapur district (0.271 million) also holds the largest population of exotic/CB sheep followed by Udhampur (0.179 million) in Jammu and Kashmir, Chittoor (0.178 million) in Andhra Pradesh and Badgam (0.168 million) in Jammu and Kashmir. Top twenty five districts holding largest population of indigenous, exotic/CB and total sheep are given in [table 6](#).

Table 6: Districts of India with highest population of indigenous, exotic and total sheep

Indigenous	Exotic	Total
Anantapur (AP, 4655449)	Anantapur (AP, 271138)	Anantapur (AP, 4926587)
Mahbubnagar (Tgn, 2252649)	Udhampur (JK, 179061)	Mahbubnagar (Tgn, 2302222)
Prakasam (AP, 1977682)	Chittoor (AP, 177607)	Prakasam (AP, 2033479)
Kurnool (AP, 1916293)	Badgam (JK, 168310)	Kurnool (AP, 1985957)
YSR (AP, 1715321)	YSR (AP, 154540)	YSR (AP, 1869861)
Chittoor (AP, 1519091)	Pulwama (JK, 133736)	Chittoor (AP, 1696698)
Chitradurga (Ktk, 1351843)	Rajauri (JK, 132262)	SPSR Nellore (AP, 1370812)
SPSR Nellore (AP, 1292290)	Baramulla (JK, 127371)	Chitradurga (Ktk, 1352087)
Tumakuru (Ktk, 1286841)	Srikakulam (AP, 114813)	Tumakuru (Ktk, 1290008)
Nalgonda (Tgn, 1077375)	Shopian (JK, 112432)	Nalgonda (Tgn, 1098300)
Barmer (Raj, 1013198)	Anantnag (JK, 111943)	Barmer (Raj, 1013419)
Bellary (Ktk, 987365)	Vizianagaram (AP, 100173)	Bellary (Ktk, 1005565)
Wanaparthy (Tgn, 975763)	Kulgam (JK, 94707)	Wanaparthy (Tgn, 976832)
Nagarkurnool (Tgn, 962156)	Kathua (JK, 79375)	Nagarkurnool (Tgn, 967926)
Jaisalmer (Raj, 835647)	SPSR Nellore (AP, 78522)	Jaisalmer (Raj, 836992)
Suryapet (Tgn, 767413)	Kupwara (JK, 77876)	Siddipet (Tgn, 801259)
Pali (Raj, 764559)	Kishtwar (JK, 70035)	Suryapet (Tgn, 779090)

Indigenous	Exotic	Total
Belagavi (Ktk, 754518)	Kurnool (AP, 69664)	Rangareddi (Tgn, 767125)
Siddipet (Tgn, 735666)	Siddipet (Tgn, 65593)	Pali (Raj, 764787)
Rangareddi (Tgn, 731191)	East Godavari (AP, 61463)	Belagavi (Ktk, 757679)
Warangal-rural (Tgn, 730095)	Reasi (JK, 58215)	Srikakulam (AP, 738910)
Nizamabad (Tgn, 710634)	Yadadri Bhuvanagiri (Tgn, 57458)	Nizamabad (Tgn, 735549)
Guntur (AP, 681669)	Prakasam (AP, 55797)	Warangal-ural (Tgn, 732481)
Jangoan (Tgn, 676237)	Mahbubnagar (Tgn, 49573)	Guntur (AP, 704863)
Mahabubabad (Tgn, 673331)	Uttarkashi (UK, 48743)	Jangoan (Tgn, 679929)

AP-Andhra Pradesh, Tlg-Telangana, JK-Jammu & Kashmir, Raj- Rajasthan, UK-Uttarakhand

In terms of density per km² Wanaparthi (453.4), Mahabubnagar (440.4), Waranagal-rural (335.7) and Jangaon (309.1) districts of Telangana has the highest density of indigenous sheep. For total sheep, Wanaparthi (453.9), Mahabubnagar (449.7) of Telangana, Shopian (365.1) of Jammu & Kashmir and

Waranagal-rural (336.8) again of Telangana has the highest density per km². For exotic/CB sheep Shopian (360.4), Kulgam (231.0), Ganderbal (171.9) and Badgam (123.7) of Jammu & Kashmir has the highest density per km² (Table 7).

Table 7: Districts of India with highest density per km² of indigenous, exotic and total sheep

Indigenous	Exotic	Total
Wanaparthi (Tgn, 453.4)	Shopian (JK, 360.4)	Wanaparthi (Tgn, 453.9)
Mahbubnagar (Tgn, 440.0)	Kulgam (JK, 231.0)	Mahbubnagar (Tgn, 449.7)
Warangal-rural (Tgn, 335.7)	Ganderbal (JK, 171.9)	Shopian (JK, 365.1)
Jangoan (Tgn, 309.1)	Badgam (JK, 123.7)	Warangal-rural (Tgn, 336.8)
Warangal-urban (Tgn, 289.8)	Pulwama (JK, 123.1)	Jangoan (Tgn, 310.8)
Karimnagar (Tgn, 284.9)	Bandipora (JK, 109.3)	Bandipora (JK, 302.6)
Jagitial (Tgn, 250.1)	Udhampur (JK, 67.9)	Karimnagar (Tgn, 300.1)
Anantapur (AP, 243.4)	Rajauri (JK, 50.3)	Warangal-urban (Tgn, 296.2)
Peddapalli (Tgn, 234.4)	Srikakulam (AP, 19.7)	Anantapur (AP, 257.5)
Mahabubabad (Tgn, 234.0)	Siddipet (Tgn, 18.1)	Kulgam (JK, 256.5)
Medak (Tgn, 225.7)	Yadadri Bhuvanagiri (Tgn, 16.6)	Jagitial (Tgn, 252.6)
Suryapet (Tgn, 212.8)	Vizianagaram (AP, 15.3)	Peddapalli (Tgn, 245.7)
Siddipet (Tgn, 202.6)	Karimnagar (Tgn, 15.3)	Mahabubabad (Tgn, 235.6)
Jogulamba Gadwal (Tgn, 196.8)	Anantapur (AP, 14.2)	Medak (Tgn, 228.7)
Bandipora (JK, 193.3)	Chittoor (AP, 11.7)	Siddipet (Tgn, 220.6)
Rajanna Sircilla (Tgn, 180.7)	Rajanna Sircilla (Tgn, 11.6)	Suryapet (Tgn, 216.0)
Yadadri Bhuvanagiri (Tgn, 171.2)	Peddapalli (Tgn, 11.3)	Ganderbal (JK, 214.0)
Nizamabad (Tgn, 165.7)	YSR (AP, 10.1)	Jogulamba Gadwal (Tgn, 197.0)
Chitradurga (Ktk, 160.2)	Mahbubnagar (Tgn, 9.7)	Rajanna Sircilla (Tgn, 192.3)
Khammam (Tgn, 152.4)	Rangareddi (Tgn, 7.1)	Yadadri Bhuvanagiri (Tgn, 187.8)
Nalgonda (Tgn, 151.3)	Warangal Urban (Tgn, 6.4)	Nizamabad (Tgn, 171.5)
Kamareddy (Tgn, 151.0)	Jayashankar Bhupalapally (Tgn, 6.4)	Chitradurga (Ktk, 160.3)
Rangareddi (Tgn, 145.3)	Uttarkashi (UK, 6.1)	Kamareddy (Tgn, 156.5)
Chikballapur (Ktk, 140.6)	SPSR Nellore (AP, 6.0)	Nalgonda (Tgn, 154.2)
Nagarkurnool (Tgn, 139.0)	Nizamabad (Tgn, 5.8)	Khammam (Tgn, 153.0)

*AP-Andhra Pradesh, Tlg-Telangana, JK-Jammu & Kashmir, Raj- Rajasthan, UK-Uttarakhand

In terms of density per 1000 households, Wanaparthi (7879.1), Mahabubnagar (7496.1) of Telangana, Jaisalmer (7131.9) of Rajasthan and Kargil (5449.0) of Ladakh has the highest density of indigenous sheep. These districts also has the highest density of total sheep

per 1000 households. For exotic/CB sheep Shopian (2531.6), Udhampur (1804.3), Badgam (1628.3) and Pulwama (1550.7) of Jammu & Kashmir has the highest density per 1000 households (Table 8).

Table 8: Districts of India with highest density of indigenous, exotic and total sheep per 1000 households

Indigenous	Exotic	Total
Wanaparthi (Tgn, 7898.1)	Shopian (JK, 2531.6)	Wanaparthi (Tgn, 7906.8)
Mahbubnagar (Tgn, 7496.1)	Udhampur (JK, 1804.3)	Mahbubnagar (Tgn, 7661.1)
Jaisalmer (Raj, 7131.9)	Badgam (JK, 1628.3)	Jaisalmer (Raj, 7143.3)
Kargil (Ladakh, 5449.0)	Pulwama (JK, 1550.7)	Kargil (Ladakh, 6283.1)
Nagarkurnool (Tgn, 4902.4)	Kishtwar (JK, 1549.1)	Anantapur (AP, 5088.6)
Jangoan (Tgn, 4856.7)	Kulgam (JK, 1284.5)	Nagarkurnool (Tgn, 4931.8)
Anantapur (AP, 4808.6)	Reasi (JK, 1026.9)	Jangoan (Tgn, 4883.2)
Jogulamba Gadwal (Tgn, 4357.8)	Rajauri (JK, 1014.3)	Jogulamba Gadwal (Tgn, 4361.7)
Kinnaur (HP, 4156.2)	Ganderbal (JK, 981.6)	Kinnaur (HP, 4219.1)
Warangal-rural (Tgn, 3893.3)	Baramulla (JK, 834.5)	Kishtwar (JK, 4160.8)
Leh Ladakh (Ladakh, 3797.0)	Kargil (Ladakh, 834.2)	Warangal-rural (Tgn, 3906.0)
Chitradurga (Ktk, 3786.6)	Anantnag (JK, 728.6)	Leh (Ladakh, 3801.2)
Medak (Tgn, 3727.3)	Uttarkashi (UK, 721.0)	Chitradurga (Ktk, 3787.3)
Mahabubabad (Tgn, 3437.3)	Kupwara (JK, 683.5)	Medak (Tgn, 3776.8)
Lahul & Spiti (HP, 3330.7)	Kathua (JK, 663.8)	Doda (JK, 3740.1)
Doda (JK, 3203.2)	Bandipora (JK, 645.7)	Lahul & Spiti (HP, 3503.1)
Yadadri Bhuvanagiri (Tgn, 3145.4)	Doda (JK, 536.9)	Mahabubabad (Tgn, 3460.5)
Siddipet (Tgn, 3090.4)	Ramban (JK, 349.6)	Yadadri Bhuvanagiri (Tgn, 3450.2)
Nirmal (Tgn, 3029.5)	Poonch (JK, 311.9)	Siddipet (Tgn, 3365.9)
Suryapet (Tgn, 2686.2)	Yadadri Bhuvanagiri (Tgn, 304.8)	Nirmal (Tgn, 3031.9)
Nalgonda (Tgn, 2681.9)	Anantapur (AP, 280.1)	Reasi (JK, 2918.5)
Rajanna Sircilla (Tgn, 2625.2)	Siddipet (Tgn, 275.5)	Rajanna Sircilla (Tgn, 2793.2)
Kishtwar (JK, 2611.6)	Kullu (HP, 245.1)	Nalgonda (Tgn, 2733.9)
Peddapalli (Tgn, 2537.9)	YSR (AP, 218.8)	Suryapet (Tgn, 2727.0)
Mancherial (Tgn, 2511.1)	Jayashankar Bhupalapally (Tgn, 208.2)	Udhampur (JK, 2710.8)

AP-Andhra Pradesh, Tlg-Telangana, JK-Jammu & Kashmir, Raj- Rajasthan, HP-Himachal Pradesh

All the districts in Andhra Pradesh have more than 0.2 million indigenous sheep. Similarly, 87.1, 53.3 and 39.4 percent districts of Telangana, Karnataka and Rajasthan, respectively, has more than 0.2 million sheep. Only sixty-eight districts in India has 50 indigenous sheep per km². Telangana has maximum percentage (90.32 %) of districts with more than 50 indigenous sheep per km²,

followed by Andhra Pradesh (84.61), Karnataka (50.0) and Jammu & Kashmir (35.0). Similarly, only sixty-five districts in our country has more than 1000 indigenous sheep per 1000 households. Both the districts of Ladakh has more than 1000 indigenous sheep per 1000 households, followed by Telangana (87.1 % of districts), Andhra Pradesh (46.16) and Karnataka (36.67) (Table 9).

Table 9: Number of districts in states and union territories with a population of 0.2 million and density of more than 50 per km² and 1000 per 1000 household of indigenous sheep

State*	Total number of districts	No. of districts with about 0.2 million indigenous sheep	No. of districts with > 50 indigenous sheep per km ²	No. of districts with > 1000 indigenous sheep per 1000 households
Telangana	31	27	28	27
Andhra Pradesh	13	13	11	6
Karnataka	30	16	15	11
Rajasthan	33	13	1	5
Tamil Nadu	32	6	5	-
Maharashtra	35	4	1	1
Gujarat	33	2	-	1
Jammu & Kashmir	20	2	7	8
Himachal Pradesh	12	1	-	4
Ladakh	2	-	-	2

*Other states/UTs have no district meeting above criteria

Population trend of breeds of indigenous sheep

India is home to more than 44 recognised sheep breeds well adapted to the agro-climatic condition of their habitat. About 39 percent of the indigenous sheep population belong to the recognized breeds (Breed survey 2013). The largest percentage of indigenous sheep of West Bengal (69.25) conform to the recognized breeds followed by Gujarat (64.08), Tamil Nadu (55.07) and Rajasthan (52.17) (Table 3). There are no recognized sheep breeds in Assam and Chhattisgarh. Although, the overall population of indigenous sheep, which includes the heads under recognized breeds as well as non-descript animals, has decreased by 9.64 percent during 2007-2012. However, the population of recognized breeds that are listed in Breed survey (2013) has decreased twice as fast (21.9 %) during this period.

Nellore breed has the largest population (6.942 million) followed by Deccani (3.723 million), Marwari (3.075 million) and Bellari (1.673 million). Among the breeds that has a population of more than 0.1 million, only eight breeds (Chottanagpuri, Muzzafarnagari, Bolangir, Magra, Sonadi, Nellore, Changthangi and Hassan) have shown an increase in their population during 2007-2012. Chottanagpuri breed has shown maximum increase (153.9 %) followed by Bolangir (93.1), Magra (62.3) and Sonadi (37.9). Kilakarsal breed has shown maximum decrease (93.0 %) followed by Vembur (85.5 %), Madras-Red (72.9 %) and Bonpala (61.2). Among the five largest breeds only Nellore have shown an increase (11.7 %), whereas, Deccani, Marwari, Bellari and Meccheri have shown decline of 14.0, 40.9, 4.64 and 31.57 percent, respectively (Table 10).

Table 10: Population of major sheep breeds, their share in descript population, percent change during 2007-2013 and major states of their distribution

Breed	Population (Breed survey, 2013)	Percent of descript population of India	Percent change during 2007-2013	State(s) holding major population (Percent of total population of the breed)
Nellore	6942182	29.19	11.7	Andhra Pradesh* (99.98)
Deccani	3723406	15.66	-14.0	Andhra Pradesh* (54.81), Karnataka (21.73), Maharashtra (23.47)
Marwari	3074952	12.93	-40.9	Rajasthan (80.03), Gujarat (19.66)
Bellari	1673154	7.04	-4.6	Karnataka (79.97), Andhra Pradesh* (20.03)
Meccheri	1212225	5.10	-31.6	Tamil Nadu (100.0)
Jaisalmeri	1018880	4.28	-46.4	Rajasthan (95.60)
Ramnad-White	710028	2.99	-53.8	Tamil Nadu (97.19)

Breed	Population (Breed survey, 2013)	Percent of descript population of India	Percent change during 2007-2013	State(s) holding major population (Percent of total population of the breed)
Hassan	703012	2.96	8.9	Karnataka (100)
Chottanagpuri	516692	2.17	153.9	West Bengal (61.69), Jharkhand (38.30)
Magra	507915	2.14	62.3	Rajasthan (98.37)
Patanwari	472997	1.99	-15.9	Gujarat (100.0)
Madras-Red	311533	1.31	-72.9	Tamil Nadu (100.0)
Gaddi	295010	1.24	-12.9	Himachal Pradesh (58.85), Jammu & Kashmir* (31.25), Uttarakhand (7.57)
Chokla	261514	1.10	-54.7	Rajasthan (96.36)
Bolangir	248986	1.05	93.1	Odisha (99.38)
Malpura	245251	1.03	-34.7	Rajasthan (100.0)
Mandya	244468	1.03	-17.3	Karnataka (100.0)
Kenguri	243023	1.02	-44.6	Karnataka (99.99)
Bonpala	231860	0.97	-61.2	West Bengal (99.13)
Garole	165531	0.70	-59.5	West Bengal (100.0)
Sonadi	157694	0.66	37.9	Rajasthan (100.0)
Pugal	99579	0.42	-40.3	Rajasthan (100.0)
Muzzafarnagari	99328	0.42	103.0	Uttar Pradesh (98.34)
Others ^{2, 3}	623628	2.62	-54.9	–
Total	23782848	–	-21.9	–

*Andhra Pradesh and Jammu & Kashmir include Telangana and Ladakh, respectively.

²Individual population of other breeds viz. Ganjam, Jalauni, Bakarwal, Shahbadi, Changthangi, Tiruchi-Black, Kashmir merino, Kilakarsal, Vembur, Coimbatore, Rampu-Bushair, Gurej, Karna, Poonchi is less than 0.1 million.

³Nali, Nilgiri, Tibetan and new breeds Katchaikatty-Black, Chevaadu, Kendrapada, Panchali and Kajali not listed in Breed survey, 2013.

CONCLUSION

Although, the population of indigenous sheep has decreased by 9.64 percent during 2007-2012, the population of recognized breeds has decreased by 21.9 percent. During 2007-2019, the population of indigenous sheep has shown an increase of only 3.46 percent compared to 9.61 percent increase in exotic/CB sheep. Further, states like Andhra Pradesh, Telangana and Karnataka that are major sheep rearing states, has shown 74 and 5.5 fold increase in the population of exotic/CB sheep. Moreover, further increase in sheep population, especially in high density states may put increased pressure on already overgrazed and shrinking pastures as more and more land is being brought under cultivation, infrastructure and reserve forest areas.

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