RESEARCH ARTICLE Agricultural Science Digest, Volume 45 Issue 4: 729-735 (August 2025)

Livestock in Madhya Pradesh and Chhattisgarh: An Analysis for Some Policy Implications

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10.18805/ag.D-5418

ABSTRACT

Background: For formulating appropriate policies for development of livestock sector, it is necessary to assess the trends and dynamics of livestock population in the two states. In this study, we assessed the dynamics of livestock population in two central states of India, *viz*. Madhya Pradesh and Chhattisgarh during the period 2003-2019.

Methods: The study is based on secondary data, sourced from various Government of India publications. The analytical tools comprised of simple descriptive statistics and fitting exponential trend equations.

Result: We found temporal variations in shares of different species to total livestock population. While population of cattle declined in Madhya Pradesh, the same registered a minor increase in Chhattisgarh. The reverse situation was observed in case of buffaloes. Within small ruminant population, importance of goats has increased compared to sheep. Rural livelihood dependency is highest on cattle in both the states. Economic dependence on sheep and pig is more in Chhattisgarh than Madhya Pradesh. The critical inputs and services availability and infrastructure for animal health care were also assessed at the respective state levels. Some policy suggestions have been given based on the findings of the study on leveraging the opportunities offered by livestock sector.

Key words: Growth, Livestock, Population.

INTRODUCTION

Madhya Pradesh in central and Chhattisgarh in eastern central regions of India are two important states where agriculture contributes significantly to the state gross domestic product. Undulating topography, large proportion of waste lands, under developed irrigation potential, low ground water utilization, large proportion of rain-fed agriculture, moderate cropping intensity and high proportion of low value crops still remain the major constraints impeding agricultural sector in both the states. High proportion (29%) of landholdings being small (<2 ha) also has adverse implications for scaling up high-value crop production.

Livestock, on the other hand, plays an important role for the rural households, in terms of not only providing food and livelihood security but also acting as sources of insurance, investment and energy and power in agricultural operations. Madhya Pradesh and Chhattisgarh are contiguous states: in fact the latter being carved out of the former in 2000 and the two states are similar in socio-economic and livestock rearing patterns (Govindaraj *et al.* 2019). In fact in both the states, among small ruminant population, goats constitute the overwhelming share >95%).

For formulating appropriate policies for development of livestock sector and thereby giving a further boost to their contributions, it is extremely necessary to assess the trends and dynamics of livestock population. There have been earlier studies which have analyzed the nature and significance of changes taking place in the livestock sector in specific states (Elumalai and Pandey, 2004; Kumar *et al*. 2007; Bardhan *et al*. 2010; Baba *et al*. 2011; Kumar *et al.* 2020). However, systemic study of the variations in the composition of livestock herds or their productivity across the two states and over time, much less to explore the factors which might explain these phenomena, has not been carried out. This paper is a preliminary attempt in that direction.

We begin by presenting salient facts regarding the size and composition of livestock populations across the two states as well as its behaviour during 2003-19. This is supported by discussion, mostly of exploratory nature, of the reasons for observed variations. We then discuss adoption of crossbreeding technology, animal health infrastructure and area under fodder crops, which constitute the critical inputs for this sector across the two states over time.

MATERIALS AND METHODS

Sources of data for this study are Livestock Censuses (17th, in 2003 and 20th, in 2019), published by Department of Animal Husbandry and Dairying, Government of India. (GOI, 2019) The other information, regarding land area under fodder and common property resources perused in the paper were collected from *Land Use Statistics* published by

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How to cite this article: Bardhan, D., Singh, S.R.K., Raut, A.A. and Athare, T.R. (2025). Livestock in Madhya Pradesh and Chhattisgarh: An Analysis for Some Policy Implications. *Agricultural Science Digest*. **45(4):** 729-735. doi: 10.18805/ag.D-5418.

Submitted: 14-06-2021 **Accepted:** 01-04-2022 **Online:** 23-05-2022

Directorate of Economic and Statistics, Department of Agriculture and Cooperation and Farmers' Welfare, Government of India (GOI, 2018).

Tabular and % analyses were carried out to ascertain the spatial, breeds/species-wise and temporal compositional changes in livestock population. The compound growth rates of population of different livestock breeds/species were estimated. Population data are available only for the Census years. As such, growth rates were calculated based on the inter-census period data and the same was used and extrapolated to generate continuous data. Exponential growth equation of the following form was used to compute the annual growth rates:

$$Y_t = a\, e^{bt}$$

Where,

Y_t= Livestock population.

a = Constant.

t = Time; 1, 2, …. n; where n is number of years.

b= Parameter to be estimated

Annual compound growth rate (ACGR) = e^b - 1

RESULTS AND DISCUSSION

Trends in livestock population

As in 2019, Madhya Pradesh and Chhattisgarh account for 12 and 7%, 3 and 0.5% and 9 and 1% of the country's total indigenous and crossbred cattle and buffalo population, respectively (Table 1). In case of indigenous cattle, Madhya Pradesh ranks 1st in the country in terms of its contribution to the country's indigenous cattle population. In case of buffaloes, Madhya Pradesh ranks 5th in the country in terms of the state's contribution to the country's total buffalo population. Madhya Pradesh and Chhattisgarh contribute about 7 and 3% of the country's goat population, respectively. Shares of Madhya Pradesh and Chhattisgarh in the country's total sheep population are non-significant. The share of Chhattisgarh (6%) in the country's pig population is higher than that of Madhya Pradesh (2%). In case of poultry, the shares of both the states to the country's poultry population are low (about 2% for each). Indigenous cattle in Madhya Pradesh, declined during 2003-2019 at a rate of 1% per annum in consonance with the national pattern; while the same in Chhattisgarh registered an increase at a rate of 0.6% per annum. Crossbred cattle population in Madhya Pradesh increased at a significantly higher rate (11% per annum) as compared to that of Chhattisgarh (0.5% per annum). Buffalo population declined in Chhattisgarh at a rate of 2% per annum, while the same in Madhya Pradesh increased at a rate of 1% per annum. In case of goat population, Madhya Pradesh (1.4%) and Chhattisgarh (3.3%), both registered a higher growth rate than the corresponding aggregate national figure (0.75% per annum). In case of pigs, while the population declined a rate of 3.5% per annum in Madhya Pradesh, in line with the national pattern; the same in Chhattisgarh registered a marginal increase at the rate of 0.5% per annum. Growth rate of poultry population in both the states (4% and 5% per

Table 1: Livestock population (thousand) and growth rate (% per annum).

States	Ind. Cattle			CB cattle			Buffaloes			Sheep			Goat			Pig			Camel			Equines			Poultry (million)		
	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)	2003	2019	ACGR (%)
MP	18595	17056		317	1679		7575	10307		546	325		8142	11065		358	165		8	2		75	24		12	17	
	(11.59)	(12.00)	-1.13	(1.28)	(3.33)	11.09	(7.74)	(9.38)	1.3	(0.89)	(0.44)	-2.84	(6.55)	(7.43)	1.44	(2.65)	(1.82)	-3.48	(1.27)	(0.70)	-8.61	(4.75)	(4.37)	-6.33	(2.39)	(1.96)	4.32
CG	8629	9717	0.63	253	258		1598	1175		121	180		2336	4006		552	527		0	0		4	1		8	19	
	(5.38)	(6.84)		(1.02)	(0.51)	0.51	(1.63)	(1.07)	-2.2	(0.20)	(0.24)	2.51	(1.88)	(2.69)	3.30	(4.08)	(5.82)	0.53	(-)	(-)	0.00	(0.28)	(0.15)	-2.84	(1.67)	(2.20)	4.87
India	160495	136746	-1.87	24686	50417	4.19	97923	109852	0.6	61469	74261	0.66	124357	148885	0.75	13519	9055	-2.16	632	252	-9.05	1579	548	-5.80	489	852	3.05

Figures in parentheses indicate share (%) in total species-wise livestock population of India.

annum for Madhya Pradesh and Chhattisgarh, respectively) have been marginally higher than the same at the all-India aggregate level (3% per annum). In both the states, indigenous cattle, among all the species, contribute the highest share to the respective state's total livestock population; the share (61%) being higher in Chhattisgarh than that (42%) in Madhya Pradesh, as in 2019 (Table 2). It can also be seen that while the share of indigenous cattle came down significantly in the former state from 52% in 2003, the same registered a marginal fall from 64% in case of the latter. In fact, Chhattisgarh ranks 1st in terms of share of indigenous cattle in the state's total livestock population among 28 states of the country. As in 2019, the shares of crossbred cattle population in both the states (4 and 2%, respectively, for Madhya Pradesh and Chhattisgarh) are significantly lower than that (9.5%) at the national level. Buffalo accounts for a significantly higher share (25%) in Madhya Pradesh, as compared to that (7%) in Chhattisgarh, as in 2019. Madhya Pradesh, ranks 6th in the country in regard to share of buffaloes in total livestock population. Next to indigenous cattle, goats account for the highest shares of total livestock population in both the states (27% and 25%, respectively in Madhya Pradesh and Chhattisgarh). Sheep contribute, relatively, miniscule shares (about 1% in each state) to total livestock population in both the states. Share of pig population in Chhattisgarh (3%) is higher than that in Madhya Pradesh (0.4%). Shares of other species, *viz*. camel and equines in both the states are negligible.

Category-wise % change in large ruminant population

As in 2019, adult male cattle in Chhattisgarh constitutes 52% of the state's total indigenous cattle population, as against that of 38% in Madhya Pradesh (Table 3). Adult male indigenous cattle population in Chhattisgarh has also registered significant growth in terms of % change (53%) in population. In contrast, adult indigenous male cattle have declined by about 8% in Madhya Pradesh and 20% at the aggregate all-India level. The increase in adult male cattle in Chhattisgarh, probably implies lower degree of mechanization in agricultural operations in the state (Singh *et al*. 2021). The negative growth in Madhya Pradesh, on the other hand, points towards declining demand for adult male indigenous cattle for draft purpose on account of increasing mechanization in agriculture in the state. In fact, Madhya Pradesh accounted for a far higher share (8.5%) of total tractors sold in India than that by Chhatisgarh (3%). Further, the number of tractors sold per thousand operational holdings is higher in Madhya Pradesh (5.5) as compared to that in Chhattisgarh (4.5). In Chhattisgarh, the share of adult milch indigenous cattle constitutes 14% of total indigenous cattle population, which is lower than the same in Madhya Pradesh (23%). Young male stock has declined during the period in both the states, implying negative replacement rate for this category. On the other hand, young female stock has increased in both the states. In case of crossbred cattle, adult milch animals constitute 33 and 40% of total crossbred

Table 2: Share of different livestock species in total livestock population (%)

States	Ind. cattle		CB cattle		Buffaloes		Sheep		Goat		Pig		Camel		Equines	
	2003	2019	2003	2019	2003	2019	2003	2019	2003	2019	2003	2019	2003	2019	2003	2019
Madhya Pradesh	52.21	41.99	0.89	4.13	21.27	25.37	1.53	0.80	22.86	27.24	1.01	0.41	0.02	0.00	0.21	0.06
Chhattisgarh	63.95	61.25	1.87	1.63	11.84	7.41	0.90	1.14	17.31	25.25	4.09	3.32	0.00	0.00	0.03	0.01
India	33.09	25.78	5.09	9.50	20.19	20.71	12.67	14.00	25.64	28.07	2.79	1.71	0.13	0.05	0.33	0.10

Source: Basic Animal Husbandry Statistics, Department of Animal Husbandry and Dairying, Ministry of Agriculture and Farmers' Welfare, GOI, New Delhi.

Table 3: Category-wise large ruminant population ('000) and % change (2003-19).

States	Adult male ('000)			Adult Milch Females			Young stock Male (<2.5 yrs.)			Young stock Female (<2.5 yrs.)		
	2003	2019	% change	2003	2019	% change	2003	2019	% change	2003	2019	% change
Ind. cattle												
Chhattisgarh	2990	4575	53.01	1085	1208	11.34	1316	1084	-17.63	1553	1896	22.09
Madhya Pradesh	6460	5962	-7.71	3289	3615	9.91	2545	1322	-48.06	3487	4626	32.66
India	54946	43941	-20.03	27626	31979	15.76	21845	11383	-47.89	26369	44482	68.69
CB cattle												
Chhattisgarh	89	47	-47.19	41	75	82.93	36	29	-19.44	47	75	59.57
Madhya Pradesh	23	134	482.61	100	593	493.00	56	106	89.29	93	656	605.38
India	1758	3226	83.50	8178	19999	144.55	3073	2113	-31.24	7438	19691	164.74
Buffaloes												
Chhattisgarh	924	448	-51.52	159	181	13.84	135	113	-16.30	190	224	17.89
Madhya Pradesh	271	304	12.18	2752	3484	26.60	911	655	-28.10	2222	4033	81.50
India	6476	3335	-48.50	33320	38161	14.53	11207	5695	-49.18	29060	45492	56.55

cattle population in Chhattisgarh and Madhya Pradesh, respectively. Share of adult male crossbred cattle in Chhattisgarh (21%) is significantly higher than that in Madhya Pradesh (9%) and that at the aggregate all-India level (7%). Increase in young female crossbred cattle stock has been significantly lower in Chhattisgarh (60%) as compared to that in Madhya Pradesh (605%), implying relatively lesser success of crossbreeding program in Chhattisgarh. Share of adult milch buffaloes is significantly lower in Chhattisgarh (19%), as compared to the same for Madhya Pradesh (41%). The share of adult male buffaloes, on the other hand, in Chhattisgarh (46%) is significantly lower than that in Madhya Pradesh. In case of adult milch buffaloes, the increase in Chhattisgarh (14%) has been significantly lower as compared to that in Madhya Pradesh (27%). The same holds true in case of young female stock, which increased by 18% in Chhattisgarh as compared to 82% increase in Madhya Pradesh during 2003-19. The decline in population of adult male buffaloes, probably imply the preference towards indigenous cattle for draft purpose.

Species-wise livestock density

In case of indigenous cattle, higher density (496) is observed in Chhattisgarh than that in Madhya Pradesh (325) (Table 4), implying the higher degree of economic importance on this species in the former state. Density of crossbred cattle at the aggregate national level (61), on the other hand is higher than both the states (32 and 13, respectively, for Madhya Pradesh and Chhattisgarh. On the other hand, density of buffalo is significantly higher in Madhya Pradesh (196) than that in Chhattisgarh (60), pointing towards high dependence on this species for livelihood of farmers in Madhya Pradesh. Sheep density per thousand rural population is significantly lower in both the states as compared to the aggregate all-India average. This provides definite indications towards low economic dependence on this species in both the states. Goat population density, on the other hand, is higher in both Madhya Pradesh (211) and Chhattisgarh (204) than that at the aggregate national level (179). The significantly higher density of pig in Chhattisgarh (27) as compared to that in Madhya Pradesh (3) imply relatively higher dependency on this species in the former state. Poultry density per thousand rural population in Chhattisgarh (954) is also significantly higher than that in Madhya Pradesh (317), pointing towards the relatively greater economic dependence on poultry in Chhattisgarh.

Extent of adoption of crossbred technology

In case of cattle, the degree of adoption of crossbreeding technology is significantly low in Chhattisgarh (2%) as compared to that in Madhya Pradesh (32%), as in 2019 (Table 5). This share, while has increased in Madhya Pradesh from 12% in 2003, the same registered a decline from 3% Chhattisgarh. As in 2019, the share of upgraded buffaloes in total buffalo population is higher in Madhya Pradesh (18%) than the same for Chhattisgarh (11%). These results, together with the discussion in the above section imply relatively higher degree of success achieved in Madhya Pradesh in crossbreeding of large ruminant population. Shares of crossbred sheep in total sheep population in both the states (4.5% and 3.5%, respectively, in Madhya Pradesh and Chhattisgarh) are higher than that at the aggregate country level. However, relatively lesser degree of crossbreeding programme is observed for pigs in both the states.

Animal healthcare services infrastructure

As in 2018, Madhya Pradesh and Chhattisgarh account for 5 and 1% share of the total number of veterinary institutions in the country (Table 6). However, a better indicator for quality of animal health infrastructure is the number of veterinary institutions per lakh total livestock units (TLU[1]). In this respect, the corresponding figure for Madhya Pradesh and

[1]TLU specifications: 1 adult milch cow/buffalo = 1 LU; 1 bull/bullock = 08 LU; 1 Ypung male, heifer, young female (<2 yrs.) = 05 LU; sheep and goats = 1 LU; 3 pigs = 1 LU and 200 poultry birds = 1 LU.

Table 4: Livestock density per 1000 rural population.

States	Ind. cattle	CB cattle	Buffaloes	Sheep	Goat	Pig	Camel	Equines	Yak	Mithuns	Poultry
	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019	2019
Madhya Pradesh	324.64	31.96	196.18	6.18	210.60	3.13	0.03	0.46	0.00	0.00	317.10
Chhattisgarh	495.67	13.16	59.92	9.19	204.33	26.88	0.00	0.04	0.00	0.00	954.51
India	170.58	60.52	131.86	89.14	178.72	10.87	0.30	0.66	0.07	0.46	1022.49

Source: Basic Animal Husbandry Statistics, Department of Animal Husbandry and Dairying, Ministry of Agriculture and Farmers' Welfare, GOI, New Delhi.

Table 5: Extent of adoption of crossbreeding technology (Proportion (%) of CB animals in total population).

States	Cattle		Buffaloes		Sheep		Pig	
	2003	2019	2003	2019	2003	2019	2003	2019
Madhya Pradesh	11.90	32.24	NA	18.41	NA	4.55	NA	6.70
Chhattisgarh	2.84	1.91	NA	11.29	NA	3.54	NA	5.04
India	5.21	6.57	NA	15.01	NA	2.05	NA	21.83

Source: Basic Animal Husbandry Statistics, Department of Animal Husbandry and Dairying, Ministry of Agriculture and Farmers' Welfare, GOI, New Delhi.

Table 6: Animal health infrastructure (No. of Vet. Polyclinics, hospitals, dispensaries, AI centres and Aid centres).

	2005-06	2009-10	2010-11	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Madhya Pradesh	4622 (4.45)	4736 (3.88)	5470 (4.21)	6353 (4.69)	6258 (4.33)	6467 (4.33)	7531 (5.14)	7441 (4.49)	8713 (5.31)
Chhattisgarh	1408 (1.35)	1025 (0.84)	1025 (0.79)	1064 (0.79)	1509 (1.04)	1644 (1.10)	1519 (1.04)	1577 (0.95)	1570 (0.96)
India	103931	121954	129964	135489	144692	149218	146550	165609	164229

Figures in parentheses indicate share (%) in All-India level.

Source: Basic Animal Husbandry and Statistics, Department of Animal Husbandry and Dairying, Ministry of Agriculture and Farmers' Welfare.

Table 7: Animal health infrastructure (No. of Vet. Institutions per lakh total livestock unit*).

	TLU in '000 (2003)	No. of Vet. Institutions lakh TLU's (2005-06)	per TLU in '000 (2019)	No. of Vet. Institutions per lakh TLU's (2017-18)
Madhya Pradesh	16201	28.53	20554	42.39
Chhattisgarh	6819	20.65	8199	19.14
India	207086	50.19	239439	68.59

*1 adult milch cow/buffalo = 1 LU; 1 bull/bullock = 08 LU; I Young male, heifer, young female (<2 yrs.) = 05. LU; 6 sheep and goats = 1 LU; 3 pigs = 1 LU and 200 poultry birds = 1 LU.

Source: Basic Animal Husbandry and Statistics, Department of Animal Husbandry and Dairying, Ministry of Agriculture and Farmers' Welfare.

Chhattisgarh as in 2018, are 42 and 19 per lakh TLU, as against the aggregate all-India level average (69 per lakh TLU) (Table 7). This indicates that the adequacy of animal health infrastructure in Chhattisgarh, is relatively more.

Feed and fodder

Feed and fodder availability is one of the most crucial determinants of sustainability of livestock sector. While in many parts of the country sheep, goat and indigenous cattle graze on pasture lands, forest areas and barren and uncultivable land (common property resources), the improved breeds of dairy animals, *viz*. crossbred cattle and buffaloes are mainly stall-fed. While the common property resources help in sustaining a number of animals which are primarily owned by marginal and small holders; land area under fodder crops becomes important when it comes to sustaining the improved and high-yielding breeds/ species of animals. Common property resources to support grazing of livestock have declined or remained stagnant in both the states during 2006-16, with the exception of permanent pastures and grazing land, which registered positive growth during this period (Table 8). On the other hand, while area under fodder crops declined in Chhattisgarh, the same registered an increase in Madhya Pradesh. The total area under cultivated fodder in the two states is not sufficient to meet the requirements of the growing livestock population. The forages offered to animal are mostly of poor quality. Dry fodder, green fodder and concentrate are deficient by 11%, 35% and 28%, respectively (Birthal, 2018). Limited land for cultivation owing to shift of land to other uses, *viz*.

urbanization and industrialization further accentuates the problem of feed and fodder deficiency. The gap in demand and supply will further rise due to consistent growth of livestock population expected in the coming years.

CONCLUSION AND POLICY IMPLICATIONS

Dynamics of changes in livestock population indicated that while cattle declined in Madhya Pradesh, the same registered a minor increase in Chhattisgarh. The reverse situation was observed in case of buffaloes. Population of goats increased relative to sheep. The study also revealed that economic dependence of rural people is high on indigenous cattle and goats and low on crossbred cattle and sheep in both states, while the same is relatively higher for pig and poultry in Chhattisgarh and buffaloes in Madhya Pradesh. Degree of adoption of crossbreeding technology in cattle, is significantly lower in Chhattisgarh, implying relatively lower degree of success of crossbreeding programme in the state. Although the preference has shifted towards the crossbred cattle for milch purpose in Madhya Pradesh, policy focus also needs to be given on conservation and propagation of the the good indigenous breeds, at least in selective pockets of both the states. Common property resources have declined in both the states at a significant rate. With area cultivated under fodder crops also declining in both the states, there is need for innovations in feed and fodder production technologies like hydroponic fodder production, development of dual purpose grain-cum fodder varieties, overlapping cropping system for round the year fodder production and convergence of National Livestock Mission support and private investment for increasing feed and fodder resources.

Conflict of interest

The authors declare no conflict of interest.

Table 8: Trends in land-use area ('000 ha).

State	Forests			Barren and uncultivated land			Permanent pastures and grazing land			Area under fodder crops		
	2006-07	2015-16	CAGR (%)	2006-07	2015-16	CAGR (%)	2006-07	2015-16	CAGR (%)	2006-07	2015-16	CAGR (%)
Madhya Pradesh	8699 (28.28)	8692 (28.26)	-0.01	1406 (4.57)	1360 (4.42)	-0.20	1348 (4.38)	1304 (4.24)	-0.52	1341	1303	-0.33
Chhattisgarh	6355 (46.08)	6314 (45.78)	-0.004	313 (2.27)	288 (2.09)	-1.46	857 (6.21)	887 (6.43)	0.44	850	887	-0.44
India	71463 (23.27)	71865 (23.35)	0.10	17287 (5.63)	16944 (5.51)	-0.11	10418 (3.39)	10262 (3.33)	-0.17	10457	10257	-0.22

Figures in parentheses indicate % to total reporting area.

Source: Land Use Statistics, Directorate of Economic and Statistics, Department of Agriculture and Cooperation and Farmers' Welfare, Ministry of Agriculture and Farmers' Welfare, Government of India.

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