

SUSTAINABLE LIVESTOCK FARMING FOR LIVELIHOOD SECURITY WITH A FOCUS ON INDIA'S BUNDELKHAND REGION

Abstract

India is wealthy in livestock number and its diversity. Animal husbandry provides nutritious food items to rural people and surplus are sold to nearby market. Thereby promotes socio-economic development of village peoples in the country. Livestock sector produce organic fertilizer for improvement of soil fertility and crop production. Bundelkhand region of central India is identified by undulated land, extreme and vulnerable climatic conditions. In this region, there are various issues like lower milk production potential of the animal, frequent disease occurrence, lack of animal health centers and services, insufficient services of artificial insemination, improper housing system, limited accessibility of nutrient rich fodder, unorganized marketing channel involving middlemen, poor income level and unawareness of the farmers about various beneficial schemes of government. Participatory research in collaboration with the different stakeholders like various curriculum-oriented institutes, farmers, industry, government, investors and suppliers is prerequisite. Consequently, dissemination of developed strategies, demonstration, and validation is also required. Further, designing of the projects should be based on the type of natural resources, economic status of the household, available facilities. Further, compatibility to the particular area is essential to facilitate better adoption and execution. Livestock rearing is identified as insurance beside natural calamities and crop failure to provide backing for the livelihood of rural households. In this review article, current circumstances of the

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India inclined specially to Bundelkhand region concerning livestock population, production, housing, health management, feed and fodder availability, livestock marketing, future opportunities in livestock sector and various constraint shave been captured with the purpose of conducting need-based research and designing region specific projects for the amenity of the farmers. There is need to strengthen scientist-farmer interface to find out various issues linked with the livestock farming and educate livestock farmers about new technologies. Getting feedback and providing solution for the obstacle faced by the livestock owner is the need of hour for improvement of living standard.

Keywords: India, Bundelkhand, Socio-economic, Rural, Farmer, Livelihood, Sustainable, Livestock

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I. INTRODUCTION

India is altogether occupied by rural population, as around two third of its residents' dwell in rural areas. About 46 percent of national income derived from rural economy as almost three fourth of manpower are bucolic (UN, 2019). Animal husbandry in our country play pivotal role in economy and livelihood of rural India. Different species of animals are utilized by the humankind for different purposes viz. food (milk, meat and egg), energy (traction and transport), wool, leather, hides, fibers and fertilizers etc., (Bettencourt et al. 2015). Apart from food production, there is great significance of livestock rearing (Birthal et al., 2002). They contribute to draught power, security, sports, research, companionship and entertainment purposes. It has crucial role in the welfare and maintenance of livelihood of rural sector as it employs farmers, labour and other part of rural society of the country in large scale (Islam et al., 2016). Around 64 per cent of rural people obtain employment from agriculture sector; moreover 39 per cent of rural income comes from this field (Chand et al., 2017).

In rural background, Agriculture and animal husbandry are intertwined mutually from long ago. Animal husbandry provide continuous source of income throughout the year on sustainable means. Livestock production furnishes procreation of regular employment and is a risk reduction strategy which supports livelihood patterns of agrarian population (Birthal and Ali, 2005). Also, women account more than three-fourth of the workforce requirement in livestock production. It serves as insurance against crop failure. Livestock rearing foothold income of about two-thirds of the rural community and Almost 19.4 million people in India get employment from this sector (MOSPI, 2017). Bundelkhand region of central India comes beneath Central Plateau and Hills Agroclimatic zone. The ecosystem is almost degraded viz. undulated topography, eroded land, low soil fertility, low rainfall, less water retention capacity and limited water resources. Moreover, the region is susceptible to drought and seasonal migration of the population. The Bundelkhand region comprises of seven districts of Uttar Pradesh (UP) viz. Banda, Chitrakoot, Hamirpur, Jalaun, Jhansi, Lalitpur and Mahoba; and six districts of Madhya Pradesh (MP) viz. Chhatarpur, Datia, Damoh, Panna, Sagar and Tikamgarh. In this area socio-economic standard of the community does not meet the level of state and national average.

Around 65% of the population in the Bundelkhand region rely on crop and livestock farming. Further, about 33% the population comes under below poverty line and majority are unemployed despite multitudinal attempts undertaken by the Governments. There are various issues concerned to unfavorable environment, poor infrastructure and extension. Lesser population density and reduced urbanization (10% of the inhabitants) was observed while, higher density of the population was seen in the Bundelkhand Plain, and intermediate parts mainly in Jhansi (FFP, 2018). While, according to Rathod and Dixit (2020) the region is mainly occupied by agrarian households where about 80% of the population is supported by agriculture and livestock farming which accomplish 96 per cent of farmer's income. In Bundelkhand region agriculture and livestock production are two major sources of income. The region is almost occupied by marginal, small and medium households. Further, animal husbandry belongs with the smallholder rural households. In Bundelkhand region of both U.P and M.P. the livestock display pronounced implications as it improves living standard of the rural people, mitigate risk and distress of the livestock farmers. The sector is capable to decrease vulnerability and furnishes better coping approach which helps in alleviation of

poverty. Preference for the particular system of livestock rearing depends on the type of species, production potential, income level, assets and; availability of feed and fodder (Samra, 2008). In animal husbandry activities women also play crucial role viz. cleaning, feeding, milking and; milk and livestock products marketing etc. Seasonal migration of the peoples is common in the region. Small ruminant, fishery and backyard poultry farming are other alternatives for securing livelihood and economy of the farmers.

There is need to restructure and rejuvenate the efficiency of animal husbandry to overcome different constraints in the development of livestock sector. Considering these aspects, in this article livestock resources, feed and fodder availability, various management practices related to livestock management, constraints, marketing, future prospects for the livestock rearing and conservation of natural resources in India particularly of Bundelkhand region have been reviewed.

II. LIVESTOCK RESOURCES

Presently, India is the largest livestock producer with 536.76 million heads. It denotes an upsurge of 4.8 % compared to the preceding census. Rural and urban tracts have livestock populations of 95.78 % and 4.22 %, respectively. As far as livestock numbers are concerned, since 1992 an unceasing increase in the population of buffalo, sheep, and goats was seen. However, the number of cattle in the country remained almost constant over the years. In addition, the population of pigs, camels, donkeys, horses, and ponies continues to decline. The cattle (36.04 % of total livestock) population predominates in India, followed by goats, buffalo, and sheep. Our country has 302.8 million bovines (cattle, buffalo, mithun, and yak). Which is rising by 1.0%. The cattle population in India is 193.5 million with an increase of 0.8% over the earlier census. The number of buffaloes in the country is 109.8 million (DAHD, 2019). Furthermore, the country currently has 212 registered breeds of livestock and poultry, including 53 for cattle, 20 for buffalo, 37 for goat, 44 for sheep, 7 for horses and ponies, 9 for camel, 13 for pig, 3 for donkeys, 3 for dog, 1 for yak, 19 for chicken, 2 for duck, and 1 for geese. (NBAGR, 2022). At present, Uttar Pradesh possesses the highest number of livestock viz. 68 million and shares 12.67 % of the total livestock population of our country followed by Rajasthan and Madhya Pradesh. U.P. (Uttar Pradesh) and M.P. (Madhya Pradesh) are the two major states in India that retain a higher number of livestock resources viz. U.P. ranks first in buffalo, second in cattle, and third in goat population while, M.P. occupies third in cattle, fourth in buffalo, and fifth in goat number (DAHD, 2019). Normally, even the landless and small category of farmer rear at least one cattle/ buffalo or a few small ruminants as assured contributors of the economy in the Bundelkhand region of India. Furthermore, the number of crossbred cattle is inconsiderable compared to the country's mean of about 15%, which indicates that the cross-breeding program is insignificant in this region (Rathod & Dixit, 2020). According to DAHD (2019), total population of cattle, buffalo, sheep, goat and pig are 39.146, 35.831, 2.080, 32.163 and 0.626 lakhs in Bundelkhand region (Table 1).

Table 1: Species Wise Total Population in Bundelkhand Region (in Lakh)

District	Cattle	Buffalo	Sheep	Goat	Pig
Banda	2.555	4.238	0.097	2.814	0.054
Chitrakoot	2.677	2.517	0.197	1.760	0.045
Hamirpur	1.412	2.385	0.125	2.993	0.033
Jalaun	2.042	3.577	0.255	3.226	0.035
Jhansi	2.268	3.066	0.423	2.604	0.040
Lalitpur	3.645	2.917	0.036	1.802	0.005
Mahoba	1.390	1.379	0.140	2.061	0.053
UP Bundelkhand	15.989	20.078	1.273	17.260	0.266
Chhatarpur	3.037	3.974	0.167	4.360	0.156
Damoh	4.801	1.377	0.024	1.512	0.038
Datia	1.142	2.901	0.143	1.637	0.035
Panna	3.655	1.979	0.109	2.031	0.073
Sagar	7.450	2.361	0.009	1.721	0.015
Tikamgarh	3.072	3.161	0.357	3.642	0.043
MP Bundelkhand	23.157	15.753	0.808	14.903	0.360
Total Bundelkhand	39.146	35.831	2.080	32.163	0.626

Source: (DAHD, 2019)

Table 2 shows that Lalitpur constitutes the highest (22.80 %) share of the cattle population in the Bundelkhand region of U.P. (U.P. Bundelkhand) whereas, Sagar comprises the largest (32.17%) share in Bundelkhand of M.P. (M.P. Bundelkhand). Banda and Chhatarpur have the highest buffalo share (21.11 and 25.22 %) in U.P. Bundelkhand and M.P. Bundelkhand, respectively. A substantial proportion is contributed by Jhansi and Tikamgarh for sheep whereas Jalaun and Chhatarpur for goats in U.P. Bundelkhand and M.P. Bundelkhand, respectively.

Table 2: Species Wise Share of Animals in Bundelkhand Region (%)

District	Cattle	Buffalo	Sheep	Goat	Pig
Banda	15.98	21.11	7.62	16.30	20.37
Chitrakoot	16.75	12.54	15.47	10.20	16.84
Hamirpur	8.83	11.88	9.82	17.34	12.31
Jalaun	12.77	17.82	20.01	18.69	13.34
Jhansi	14.18	15.27	33.24	15.09	15.07
Lalitpur	22.80	14.53	2.82	10.44	1.96
Mahoba	8.69	6.87	11.02	11.94	20.10
Total UP Bundelkhand	100	100	100	100	100
Chhatarpur	13.11	25.22	20.63	29.25	43.26
Damoh	20.73	8.74	2.98	10.14	10.62

Datia	4.93	18.41	17.72	10.99	9.63
Panna	15.78	12.56	13.44	13.63	20.35
Sagar	32.17	14.99	1.08	11.55	4.09
Tikamgarh	13.27	20.07	44.15	24.44	12.05
Total MP Bundelkhand	100	100	100	100	100

Source: DAHD (2019)

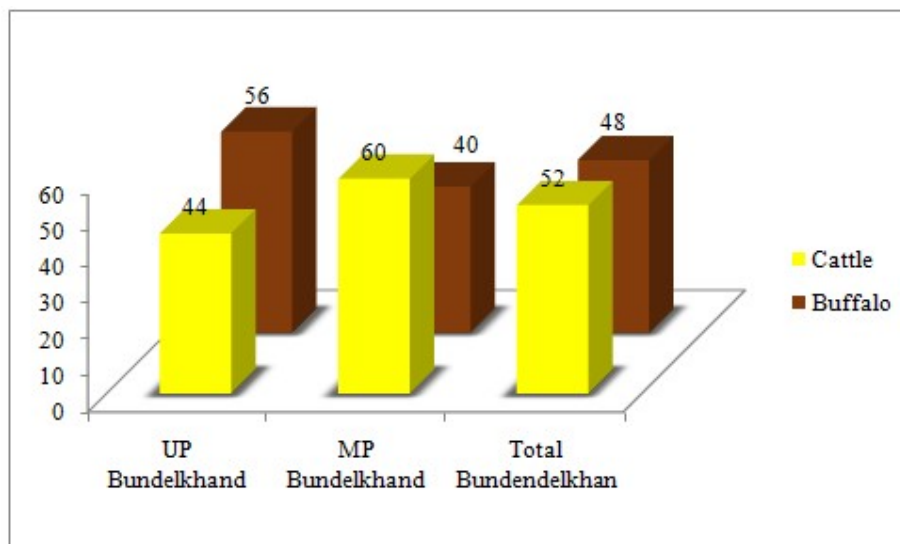


Figure 1: Bovine Population of Bundelkhand Region, Source: DAHD (2019)

In Bundelkhand (Figure 1), cattle and buffalo make up 52.21 and 47.79 percent of the total bovine population (7497637). Table 3 shows that out of the total cattle population in U.P. Bundelkhand, male cattle comprise 10.89% and female cattle constitute 89.11%. In U.P. Bundelkhand, males and females make up 7.52 and 92.48 percent of buffalo, respectively. In M.P. Bundelkhand, male and female cattle account for 32.64 and 67.36 %, respectively. Male buffalo shares 9.50 % and female 90.50 %, respectively.

Table 3: Share (%) of Male and Female in Total Population of U.P. and M.P. Bundelkhand Region, Respectively

Species	U.P. Bundelkhand		M.P. Bundelkhand	
	Male	Female	Male	Female
Cattle	10.89	89.11	32.64	67.36
Buffalo	7.52	92.48	9.50	90.50
Sheep	19.14	80.86	21.37	78.63
Goat	17.46	82.54	18.58	81.42
Pig	29.79	70.21	33.93	66.07

Source: DAHD (2019)

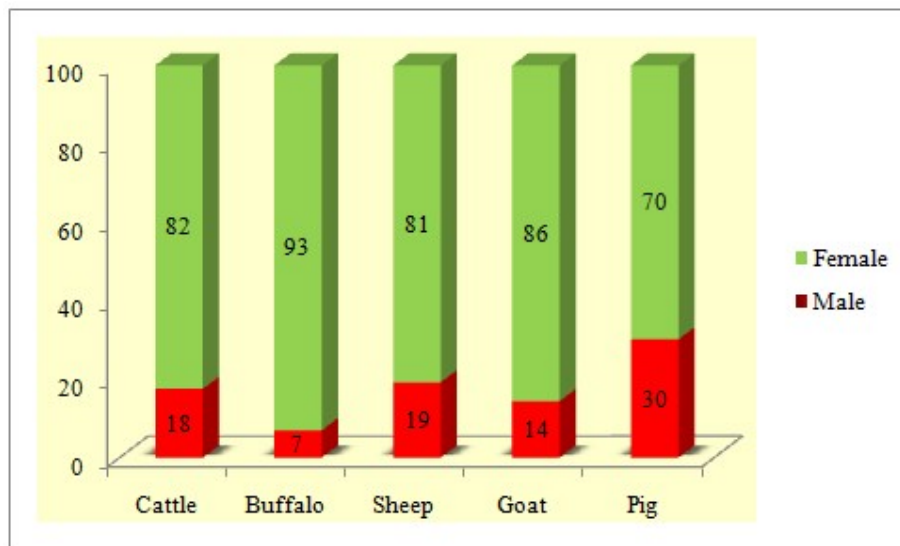


Figure 2: Share (%) of Male and Female in Total Population of Bundelkhand Source: DAHD (2019)

As far as the Bundelkhand cattle population is concerned (Figure 2), males contribute 17.53 % and females 82.47 %. Buffalo accounts for 6.95 and 93.05 percent of the male and female population, respectively. A similar pattern of male and female ratios is observed in sheep, goats, and pigs as well.

Table 4: District-Wise Share (%) of Animals from Bundelkhand Region in total Population of Respective States.

District	Cattle	Buffalo	Sheep	Goat	Pig
Banda	1.34	1.28	0.99	1.94	1.32
Chitrakoot	1.41	0.76	2.00	1.22	1.09
Hamirpur	0.74	0.72	1.27	2.07	0.80
Jalaun	1.07	1.08	2.59	2.23	0.87
Jhansi	1.19	0.93	4.30	1.80	0.98
Lalitpur	1.92	0.88	0.36	1.24	0.13
Mahoba	0.73	0.42	1.42	1.42	1.31
Total Bundelkhand of UP	8.41	6.08	12.92	11.92	6.50
Chhatarpur	1.62	3.86	5.13	3.94	9.47
Damoh	2.56	1.34	0.74	1.37	2.33
Datia	0.61	2.81	4.41	1.48	2.11
Panna	1.95	1.92	3.34	1.84	4.46
Sagar	3.97	2.29	0.27	1.56	0.90
Tikamgarh	1.64	3.07	10.99	3.29	2.64
Total Budelkhand of MP	12.35	15.28	24.88	13.47	21.90

Source: (DAHD, 2019)

Table 4 depicts that Lalitpur shares about 1.92 % of the total cattle while Banda consists of 1.28 % of the overall buffalo population of Uttar Pradesh. Bundelkhand occupies 8.41 percent and 6.08 percent of U.P.'s cattle and buffalo population. On the other hand, Sagar and Chhatarpur account for 3.97 and 3.86 % of M.P.'s cattle and buffalo population. The cattle and buffalo population of M.P. Bundelkhand shares 12.35 and 15.28 %, respectively of the total cattle present in Madhya Pradesh. In (DAHD, 2012), it was stated that cattle from U.P. Bundelkhand account for 10.54% of the overall cattle population in U.P. However, in (DAHD, 2019), it was reported that the number of cattle from U.P. Bundelkhand only accounts for 8.41, which is a decline of 2.14 percent. However, the share of cattle in M.P. Bundelkhand was 12.30% (DAHD, 2012) and 12.35 % (DAHD, 2019) of the M.P. with an increase of 0.05 % (Table 5). The proportion of buffalo from U.P. Bundelkhand and M.P. Bundelkhand to the total respective state population increased by 1.04 and 2.08 %, respectively over the previous census (DAHD, 2012, 2019).

Table 5: Comparative Share of Bundelkhand Region in Total Population of U.P. and M.P.

Species	U.P. Bundelkhand vs Total U.P.			M.P. Bundelkhand vs Total M.P.		
	2012 (%)	2019 (%)	Trend	2012 (%)	2019 (%)	Trend
Cattle	10.54	8.41	-2.14	12.30	12.35	0.05
Buffalo	5.04	6.08	1.04	13.20	15.28	2.08
Sheep	10.81	12.92	2.11	18.07	24.88	6.82
Goat	9.69	11.92	2.23	12.05	13.47	1.42
Pig	6.87	6.50	-0.38	18.42	21.90	3.48

(DAHD, 2012, 2019)

Table 6 shows that the cattle share from the Bundelkhand region to the total cattle population of India declined by 0.83 %. Buffalo's contribution to the overall population of our country increased by 0.57 % compared to the last livestock census report (Figure. 3).

Table 6: Comparative Share of Bundelkhand Region in the Total Population of India

Species	Bundelkhand vs India		
	2012 (%)	2019 (%)	Trend
Cattle	2.17	1.34	-0.83
Buffalo	2.44	3.01	0.57
Sheep	0.31	0.27	-0.04
Goat	1.83	2.16	0.33
Pig	1.09	0.57	-0.52

(DAHD, 2012, 2019)

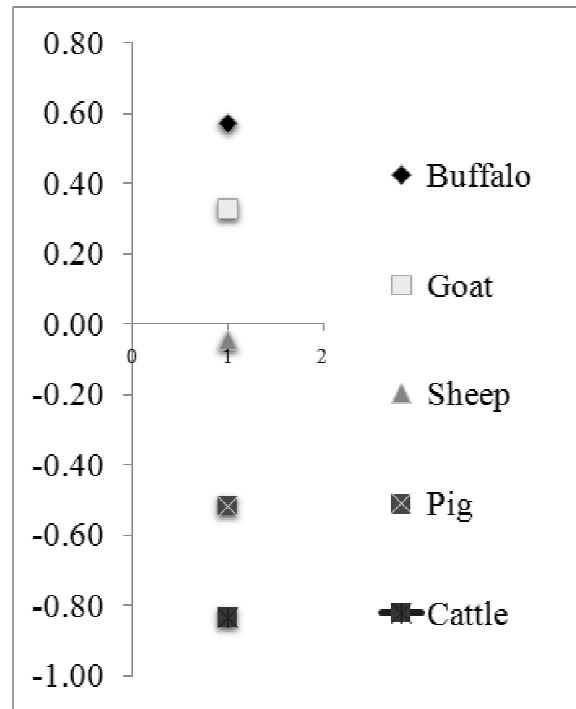


Figure 3: Growth Rate of Livestock in Bundelkhand Region

- Livestock Enterprise and Livelihood:** The livestock industry is growing steadily as an agricultural subsector in our country. A wide range of food and non-food components are available in it. Livestock supply milk, eggs, meat, and wool. Livestock products are a rich source of nutrients such as protein, vitamins, minerals, and all essential amino acids (Górska-Warsewicz et al., 2018). At present, milk production is 221.1MT with a growth rate of 5.29% annually (BAHS, 2022). According to estimates, Indian and crossbred cattle produce roughly 3 kg and 8 kg of milk daily, respectively. Buffalo contributes around 45 and cattle 52 % of the total milk production of the country. This indicates that cows contribute more than half of the country's milk production. Buffalo milk is rich in fat, unlike cattle milk, which fetches a higher price. India is the world's largest milk producer, accounting for 23.77 % of total milk production (FAO, 2022). In India, the per capita availability of milk is about 444 grams/day which is more than the 280 ICMR recommendation (BAHS, 2022). Further, according to (BAHS, 2022), Rajasthan is the top milk producer in our country with 33.26 MT followed by Uttar Pradesh (33 MT). Presently, egg production in the country is 129.6 billion eggs per year, with an annual growth rate of 6.19%. India's meat production is 9.29 MT and grows annually at 5.62%. Wool production is decreasing gradually and currently stands at 33.13 million kg. It decreased by 10.3% from the preceding year.

Furthermore, livestock farming contributes to livelihood security and coping strategies for resource-poor households in Bundelkhand. Yet, the livestock sector progression is unsatisfactory compared to other sectors of our country (Rathod & Dixit, 2020). As per the Government of Uttar Pradesh (Go UP) report, the average milk yield per animal is poor. This might be due to a deficiency in fodder and the animal's lower

production potential. Daily milk yield per animal is about 8.4, 4.5, 3.5, and 0.8 kg/day for crossbred cattle, buffalo, non-descript cows, and goats, respectively. Total annual milk production for buffaloes, non-descript cows, crossbred cattle and goats is 20.6, 5.9, 5.2 and 1.3 MT, respectively (Go UP, 2022). In addition to livestock production, landless people also work as laborers (Mishra et al., 2010; Singh et al., 2009). Animals are raised for milk, manure, draught power, and revenue in the Bundelkhand of central India. Non-descript and low-yielding cattle exist in the region. Cow productivity varies from 0.5 to 1.5 kg per animal per day. Most of the time, 4-10 adult bovines per household were observed in the area. During the monsoon and summer, livestock farmers usually let their animals graze on pasture land. Crop production dominates the region, followed by vegetable cultivation and dairy farming. The average farmer's land holding size is about 2.38 ha of land. Further irrigated land is also hired particularly by landless, marginal, and small farmers (FFP, 2018). Buffalo rearing is favored (Rathod & Dixit, 2020; Sankhala et al., 2016) mostly by livestock keepers (5.19 per household) after which goat farming continues (1.16 per household) in the Bundelkhand region. Marginal and small farmers raise sheep. More inclination towards buffalo farming might be attributed to its adaptability to changing climatic conditions. Households acquire income from milk production of around ₹ 55958 annually which is primarily more in large and small farmers. As per the investigation in the cluster of villages in two blocks namely Baragaon and Babina under the Bundelkhand region of Jhansi district, migration activity was not found among rural households (FFP, 2018). Owing to better vegetation cover and fodder availability, the watershed group of villages accounted for larger herds than the control. Crop enterprises constituted a larger proportion of income (68 and 47%) for livestock households in both watershed and control villages, respectively. Due to low milk productivity, livestock enterprises contributed very little to the income of both groups of villages (Mondal et al., 2014). Moving further, Bundelkhand's socioeconomic status is very low. Small ruminants such as sheep and goats are efficient options for poor livelihoods. A goat is also considered a "poor man's cow". Small ruminants are a major source of economy for the agrarian peoples in the uncultivated and rocky region where crop and dairy products are not feasible as it has the potential to survive in adverse situations, low-quality feed, lower initial investments, has more reproductive efficiency, rapid sexual maturity, immune power and due to ease in marketing (Kumar et al., 2010). Small ruminants are owned for meat, wool, hair, and skin. Further, the goat is also reared for milk which provides nutrition and is used for medicinal purposes. In the Bundelkhand region of the country, goat husbandry is practiced by around 45% of landless and 40% of marginal households for meat. This enterprise is a risk mitigation strategy. Because of its good adaptation ability, the local breed of "Bundelkhandi" is often raised in most tracts. As a result of their rapid growth rate and high-quality meat, goat breeds such as "Jamunapari" and "Barbari" have been raised by most of the community for a long time. Majority of cattle are pasture-grazed, and stall-fed systems are rare. Goat rearing is more common than sheep farming in this region (Samra, 2008). More than 75% of households adopt goat rearing irrespective of their caste or assets. Apart from income, it promotes crop farming as it provides cash for critical inputs. Most of the goat farmers belong to the backward social community (54%), followed by schedule caste (37%) and general category (9%). Even though marginal and small households earn more income from goat farming, all categories of farmers practice it. Apart from providing nutrition for people, goats provide about 14-16 % of the average household's income. Goat farming is associated with other livestock species and crop production. Goats are reared with cattle

and buffaloes by about 34 % of households, followed by cattle alone (15%) and buffaloes (14%). Around 37% of farmers rear goats. Sheep share 2.8 % of the livestock population based on the study conducted in the two districts, viz. Hamirpur and Mahoba in Bundelkhand, Uttar Pradesh. During the grazing period, goats are monitored by girls and women (24%), followed by male children (16%), aged people (21%), and youths (39%) (Singh et al., 2013). Livestock farming is important for nutritional security and rural poverty reduction leads to employment opportunities and women empowerment (Saxena et al., 2020).

- 2. Nutritional Security:** Lack of adequate and good quality feed resources has been observed one of the major repressions in increasing productivity of livestock. Shortage of fodder in the region during lean period including rainy season also forces farmers to leave cattle free for grazing in the field/pasture land. It is primeval tradition which is practiced most commonly in the Bundelkhand region particularly after harvesting of the rabi crop (*Anna Pratha or Chhooth Pratha*). Almost 25-30% of the kharif crop yield is destroyed by the roaming animals. Majority of the animals get away from their home die owe to underfed. According to observation in the area, there are inadequate grazing resources. Due to vagaries of rainfall, limited soil fertility, lack of inputs, land and irrigation system, cultivation of fodder is restricted in the area. Farmers are resistant to allocate their agricultural land for cultivation of fodder due to inefficient milk collection facility in the region. (Rathod and Dixit, 2020). Scarcity of fodder and reduction of common property resources are the most critical obstacle for the livestock feeding management. Grazing stress is constantly increasing on the pasture lands and their production capacity (Saran et al., 2000; Dixit et al., 2012). Moreover, livestock number is continuously increasing but carrying capacity of grazing resources is regularly declining both in terms of quality and quantity. Deficiency of nutrition and poor handling of livestock by semi-skilled paravets has resulted in the prevalence of infertility in the region (Rathod and Dixit, 2020). Report of NDDDB (2017) indicates that less than 1% of land among gross sown area is reserved for fodder production. Well planned approach for forage seed production is lacking which results in shortage of feed and fodder. For livestock feeding, crop residue constitutes around 70% of fodder requirement. But, scarcity of rainfall causes decreases in crop yield which results in reduction of crop residue in the region (Rathod and Dixit 2020). Similarly, NIANP (2012) also reported deficiency of dry matter in our country. Very small number of farmers used to offer concentrate especially to pregnant and milking cattle. Because of higher cost linked with the feeding, provision of different ration contributing enhancement of milk fat content is not recommended to the farmers (Singh, 2014).

During summer season, the rural peoples in our country used to feed their animals usually dry roughage and very little amount of concentrate. Further, cereal green fodder is fed in rainy while, leguminous green fodder is provided to the animals during winter months (Singh et al., 2021). A survey undertaken in the Bundelkhand region of India depicted crop residue as major resources for the livestock feed. From the cultivated fodder during rabi season, around 41%, 40% and 13% of feed availability furnished by the Berseem as green fodder and wheat and peas straw as dry fodder, respectively. During kharif, sorghum constituted about 58% of livestock feed subsequently 21.23 % and 16.68 % by the crop residue of soyabean and black gram, respectively. Moreover, during rabi season, more than 88% of dry fodder and 86% of green fodder was acquired annually

(Saran et al., 2000). Further, farmers should be encouraged to grow nutritionally rich legume fodder. Drought tolerant species like cactus may be planted on field bunds and undulated lands. Occurrence of recurrent droughts has been common in the region for the time being in-situ conservation of fodder is essential to facilitate easy transport between different zones (Samra, 2008). Green fodder and grasses need to be conserved in the form of hay and silage so that sufficient supply of feeds and fodder to the animals can be achievable during lean season. Conservation of forest resources is highly essential. To supply ample amount of fodder to the livestock, forest flora needs to be preserved. It is required to practice controlled and rotational grazing focusing protection of natural resource (Samra, 2008). Under Farmers First programme, high quality fodder varieties like sorghum, pearl millet and cowpea were demonstrated during kharif season. It was shown that yield of better type sorghum was 15 per cent more than the local variety. Green fodder production of pearl millet and cowpea were 299-327 and 223-240 q/ha, respectively. The experimental group of growing goats or kids provided concentrate mixture attained greater daily body weight gain relative to non-supplemented. Silage preparation was demonstrated at the village Pali, Parwai, Palinda, Datarnagar and Dhimarpara under project taking green fodder of sorghum (FFP, 2018). Goats are mainly provided crop residues viz. legume and cereal straw; and lopped fodder procured from grazing fields like bargad, pipal, shrubs and grasses. Goat production is practiced on common property resources (CPRs) under extensive system by about 47 per cent goat farmers those possess medium to large sized flocks. Providing cultivated or lopped fodder and presence of biomass in the pasture area improves performance of the goats (Singh et al., 2013).

Average productivity of the animal is lower in the region which results in higher cost of milk production. Usually, non-descript indigenous cattle of very low productivity accounts for major cattle population followed by buffalo population in the region (Rathod and Dixit, 2020). Moreover, free grazing animals acquire fewer nutrients from the field; therefore, they have lower productivity. On the other hand, feeding of concentrate in stall fed animal enhance milk productivity, thus higher investment results in increment of income and economy of the dairy farm (Shalander et al., 1994; Shah et al., 1995; Lee, 1995). At the time of scarcity of green fodder, farmers provide concentrates added with dry fodder and soaked oil-cakes to the milch animals (Saran et al., 2000). But, in this region, grazing of the animals is favoured by most of the livestock keepers instead of stall feeding at home. Further, fodder availability in the region can be enhanced by adopting measures for the conservation of soil and water resources. Sustainable agriculture farming and improvement of crop yield enhance availability of crop residue and fodder to the animals in the villages coming under watershed project (Mondal et al., 2014).

- 3. Housing Management Systems:** Majority of the farmers in Bundelkhand districts keep their animals in mud houses i.e. earthen floor and walls, thatched roof. Most of the livestock owner lack feed manger, waterer and feed store. In this area mainly four types of livestock rearing have been noticed i.e. Free Range Grazing system, Mixed system, Extensive Stall fed system and Intensive Stall fed system. The livestock farmers primarily follow uncontrolled free range grazing practices mainly for rearing small ruminants and indigenous cows in the belt which are in the proximity of forests. For the buffalo farming intensive stall-fed system is very scanty and particularly experienced in the irrigated peri-urban areas. In Bundelkhand, rearing of buffalo is favoured over cattle among large

ruminants whereas, goat husbandry over sheep as far as small ruminant is concerned. Commercial goat farming would be better than traditional system to promote better livelihood. Superior goat breeds like Jamunapari and Barbari need to be introduced. Commercial poultry farming is yet to develop in the sector as primarily confined to backyard (Samra, 2008). Separate houses were constructed for large flock (more than 10) of goats. Goats are raised in open verandah in summer and inside shed in winter season during night time. Owing to poor financial status of goat keeper, the housing facilities are inferior like limited ventilation (Ekambaram et al., 2011; Singh et al., 2013). Bundelkhand farmers pay less attention toward livestock housing due to Anna Pratha. Mostly, locally available construction materials are utilized for making of the livestock sheds and floor are made kachcha followed by semi-pucca. Further, some households having two to three animals used to keep them beneath the tree or other fallow land.

- 4. Hygiene and Healthcare Practices:** Washing of animal and cleaning of the shed is not a routine practice which causes poor hygiene and incidence of various diseases in the herd. Most of the farmers follow knuckling method for milking of animals followed by stripping. For cleaning of milking utensil, they use water and ash, and only some use detergents, further milking utensils are rarely dried after washing. Bedding materials used during calving are dry fodder and crop residues, moreover for bringing of warmth to the calves and mother during winter season, they burn stored dung cake and crop residue. Cloth or jute bag/gunny bag are utilized for cleaning of newly born calves, and they prefer natural shedding of navel cord instead of cutting (Singh, 2014; Rathod and Dixit, 2020). Disposal of livestock excreta is not organized accurately. Either they apply directly on the field or make cow dung cakes. Manure pits are scarcely located. There are limited facilities to dispose the dairy waste in eco-friendly manner like composting, vermin-composting and biogas production etc. In Bundelkhand region, occurrence of infectious diseases is one of the major reasons of low livestock productivity. Further, this issue becomes aggravated owing to unawareness of dairy farmers about health management practices like vaccination and deworming. Also, farther location of veterinary hospitals from the farmers dwelling, limited availability of veterinary doctors and higher price of veterinary aids contributes to poor health and welfare; and lower production capacity of the livestock. Occurrence of various diseases varied from 20 to 60 per cent which induces 10-35 percent goat mortality. Broad fluctuation in disease occurrence might be due to different level of nutrition, housing, health care practices like deworming and vaccination. Major diseases noticed in the Bundelkhand were foot and mouth disease, pneumonia, PPR, enterotoxaemia, colibacillosis, anemia, diarrhea, foot-rot and parasitic diseases. PPR and FMD outbreaks are more prevalent because of contaminated pond water consumption, combined grazing and housing (Singh et al., 2013). Because of lack of knowledge, the farmer do not make own attempts for vaccination and deworming. Moreover, pharmaceutical shop and input dealers are primary source of information for animal health. During disease outbreak in animal herd, farmers apply particularly traditional procedures or consult progressive farmers or pharmaceutical stores. Very small number of farmers communicate veterinarian for health care of animals. Further, farmers are more conscious about cross-bred cows and buffaloes in health-related perspectives (Rathod and Dixit, 2020). Veterinary services are not accessible by the most of the households owing to poverty, underdevelopment and lower socio-economic status.

In the area, some indigenous traditional knowledge exists among the livestock keeper. Indigenous traditional knowledge of the rural people concerning medicinal and insecticidal features of herbal plants and other crude materials has documentary evidences formerly. It further approves talent of the farmers about utilization of traditional practices in the farming (Anonymous, 1985; Srivastava et al., 2000). For treatment of Foot and Mouth disease they use alum for washing, apply warm leaves of *Calotropis procera* (Aak) and *Butea monosperma* (Dhak) on the body parts affected by FMD. On the feet and back region, red or black soil is applied. In case of cold and fever, paste of Jaggery, fenugreek powder, aniseed and ginger are used. For diarrhoea or dysentery, they administer paste of *Cassia fistula* (Amaltas) seed orally; also apical part of *Atylosiascaraeoides* (Kulthi) is fed to the animals. Several other traditional practices exist in the region which is eco-friendly, economical and accessible. Women are more acquainted in the area of indigenous traditional knowledge (ITK) concerned with various plants and other natural resources in containment of animal diseases. Moreover, grandmas are more experts than young. Most of the farmers in Bundelkhand area follow traditional system of health care acquired from their ancestors. Traditional curers are usually adopted by economically poor section of society while, veterinary hospitals are accessed by the wealthy peoples. The above observation illustrates that ITKs are more reliant on sex, age and financial state of the rural households (Mishra et al., 2010). Underneath Farmer FIRST programme livestock health camp organized in order to educate farmers about animal management, diseases and to seek their problems with the intention of implementation of appropriate practices, preventive measures of various prevalent diseases and treatment of the animals suffering from various disorders (FFP, 2018). According to record, veterinary institutes are around 277 and 5,062 in Bundelkhand region and Uttar Pradesh, respectively (NDDB, 2017). Apart from treatment, veterinary officers have other responsibilities like monitoring and evaluation of various schemes, AI, assisting governance of block and districts etc. Vaccination was carried out in contempt of Hemorrhagic Septicemia (HS), Black Quarter and; Foot and Mouth Disease (FMD) under the vaccination programme conducted by State Animal Husbandry Department (Rathod and Dixit, 2020). According to information furnished by the **Go UP (2019)**, the department committed around 6,430,000 vaccinations in bovine in Bundelkhand region during 2015–16.

- 5. Animal Reproduction Strategies:** As per the observation in Bundelkhand region of the country the age at first service varies from 36-42 and 48-54 months in the cow heifer and buffalo heifer, respectively which is responsible for shorter productive life in the animals. Indigenous cattle and buffaloes attain late puberty resulting in late pregnancy and first calving. Higher range of temperature and prevalence of drought causes longer age at first service. Prevalence of reproductive disorder is due to unfavorable climate and poor management systems followed by the rural households (Dixit *et al.*, 2020). Similarly, thermal stress on animals lowers estrus sign and rate of conception (Upadhyay et al., 2007). Further, Maurya (2010) also observed increment of service period and dry period of the animals as a result of drought. Proneness to heat stress causes summer sterility, affects reproductive performance and hormonal balance of animals in both female as well as male (Ahmad et al., 2020). Further, lack of feed and fodder in terms of quality and quantity provoke the problem.

Breedable population of cattle and buffaloes are low in the region. Main breeds among buffaloes are Murrah and Bhadawari while in cattle Hariana, Sahiwal and Gangatiri, moreover Jersey crossbred predominate over HF crossbred. Due to unorganized crossbreeding programme and indiscriminate breeding, indigenous blood of livestock is diminishing in the region. Rathod and Dixit (2020) noticed that for the conservation of indigenous breeds, livestock conservation policy need to be restructured based on necessity in the field level, also demand driven attempts are prerequisite. More attention should be given for implementation of livestock breeding policy. For the breeding of animals, they adopt AI but natural service with pedigree bull is prioritized if farmer observe lower conception rate with Artificial Insemination (AI). Generally experienced dairy farmers are interrogated for heat detection and pregnancy diagnosis while, some require veterinarian (Rathod and Dixit, 2020). Artificial insemination is not efficient in the region and does not meet the optimum standard level which leads to diminution of genetic improvement programme (Samra, 2008). Paravets are involved in carrying out AI but they are not so efficient, further in order to earn livelihood they perform unlawful veterinary services and results in suffering to both animals and dairy farmers. Infertility has become a major issue due to unorganized devising of crossbreeding programme in the region. Breed development programme is affected by the Anna Pratha because local bulls roaming in the field impregnate the cows around them affecting potency of AI campaign in Bundelkhand region (Rathod and Dixit, 2020). Moreover, scarceness of good genetic merit buck and inbreeding are limitation in goat raising (Singh and Rai, 2006; Gaur and Pathodiya, 2008; Singh et al., 2009). At present around 30% of the breedable cattle and buffaloes are covered by AI. Key participator in this area is BAIF, Animal Husbandry department (AHD), State Dairy Federation (SDF), IndiaGen and self-employed paravets. As per survey maximum number of artificial fertility centers is present in the Lalitpur and Jaluan of Bundelkhand region (NDDB, 2017). BAIF has established 174 centers for performing AI in the region (BAIF, 2018). As per 2014–15 in bovine around 2,81,000 AI were accomplished by the Government organization whereas, 1,20,000 AI by BAIF Centers (NDDB, 2017) in the Bundelkhand region.

- 6. Livestock Marketing:** In the region, marketing channel for animals and their products are almost unorganized. Marketing of livestock and various products encompass middlemen thus farmers do not get real price of their produce. Only 40-50% of the price paid by consumers reaches to livestock owners (Padda and Thind, 2002). Unorganized sector manage 80 per cent while organized sector overlook only 20 per cent of the total milk produced by rural households in the country. (Rajendran and Mohanty, 2004). During transportation of livestock, rules and regulations recommended by the governments are generally scorned. Pirated slaughter of animals is undertaken without appropriate clinical surveillance. Moreover, benefit of the sector is affected by filthy situation of slaughter houses and climatic concerns. The contractors exploit entire structure through marketing of livestock by-products (Das et al., 2006). Marketing structure in Bundelkhand region is highly disintegrated. The farmers consume livestock products or either sells locally or through various intermediaries. Thus, they do not obtain actual value of livestock and its products. They are in a situation of selling the products forcibly as these are perishable in nature. In the village poultry birds are purchased by the retailers from the farmers. They transport to local market place for slaughter and selling on daily basis. There is inadequate cold storage chain, further, facilities for value addition

are lacking in the region. Short shelf life of different products and unfavorable hot–humid climate disrupts selling process.

Bundelkhand peoples used to sell majority (70%) of the male goats till 6 months of age, while raise females for breeding. Around 92% of male goats were marketed through middleman but, about 82% of female goats were sold among goat farmers. Hamirpur and Mahoba districts accounts 71.4% and 68.5% sale by middleman, respectively (Dixit and Shukla, 1995; Senthil Kumar et al., 2012; Singh et al., 2013). About 64 per cent of the total economy from goat raising comes from goat kid selling. After family consumption the milk of goat is sold. Amount of milk contained for family consumption was 25.9% and 40.0% in the Hamirpur and Mahoba districts, respectively. Marketing of goat milk constitutes 16 per cent of the total economy from goat husbandry. As most of the household rear a smaller number of goats, therefore goat milk selling is unusual, moreover main barriers are low production, high labour expenses, and less milk price (Singh et al., 2013). Dairy cooperatives are relatively unsound in furnishing competitive value for the produce and systematic milk collection facilities. Only small number of dairy societies are engaged in providing livestock services such as distribution of livestock feed, fodder seed, etc. up to some extent. Further, participation and dominance of private players in milk processing and marketing aggravate the condition of poor farmers (Rathod and Dixit, 2020).

It is required to strengthen marketing system for the development of rural society. Traditional milk marketing channel should be replaced with modern Private – producer – consumer cooperative entrepreneurship which enables farmers to fetch true price of their livestock products (Samra, 2008). Dairy cooperatives of Gujarat plays significant role in the organized marketing chain for milk and milk products (Sirohi and Chauhan, 2011). Dairy farmers have to borrow money from the moneylenders and other input dealers in high interest rate. Considering these aspects, they should be provided quality inputs and technologies from recognized services in reasonable rate to reduce production cost and facilitate efficient marketing of livestock products (BIRTHAL et al. 2017). Challenges in the livestock marketing can be suppressed by shifting towards scientific modernization for increasing profitability.

- 7. Watershed Model and Interventions:** From a long back watershed model were implemented in various aspects considering ecological background viz. soil, land topography and water availability as the region had been prone to natural calamities like droughts etc. The region experienced water scarcity with decreased water table which pressurizes various agencies for taking initiatives in this direction (Rathod and Dixit, 2020). GIS, multi influencing factor (MIF) and remote sensing were utilized for carrying out hydrogeological evaluation in the watershed area. Based on the results precipitated water was infiltrated into the groundwater potential zones with deficient in water in order to promote recharge of ground water (Pande et al., 2020). Further, Sahu and Jhariya (2022) reported to decrease rate of pumping by 20% for mitigating water table depletion and SO₄ concentration in the area experiencing problem of water scarcity. A survey conducted under watershed management programme showed improvement in various sectors like agricultural, livestock, socioeconomic and environmental attributes. With this, food security was also ensured because of increase in agricultural production. Further, prerequisite of NRM programme for sustainable development was perceived by

80% respondents (Bhardwaj et al., 2021). Socio-economic status of the rural households has been assessed and accordingly supports are provided in many ways. It is required to take feedback about interventions undertaken in the Bundelkhand region in order to design need-based research, projects and technologies in the area. Natural Resource Management (NRM) programmes should be designed and executed by the policy makers, research institutes and other watershed accomplishing organizations, considering livestock scenario as well as economy from livestock enterprise, apart from agriculture related activity. Implementation of animal husbandry-based intervention must be required to provide benefit to livestock dependent livelihoods and assist them to continue livestock production in coming time. Extension services and training programmes are less structured which results in unawareness of the farmers about various schemes and programmes. Budget allocation by department of animal husbandry in the direction of extension and training programme is scanty (Chander and Rathod, 2013). However, BAIF is performing better in the region through educating the farmers and providing support. Collaboration among different organizations like State Agriculture, Veterinary Universities and ICAR institutes etc., is lacking (Rathod and Dixit, 2020). Therefore, providing information to farmers about technologies, modern livestock farming, economy and marketing systems is highly essential attribute. It can be feasible through extension workers, policy makers and scientists. FFP (2018) implemented Farmer FIRST project in two blocks namely Baragaon and Babina of Jhansi district and as per the study in the cluster of villages of Bundelkhand, it was shown that around 95.44 and 89.12 per cent farmers were reliant on mainly fellow farmers and market intermediaries/shopkeeper for enlightenment and information. Perception of farmers about department of agriculture and animal husbandry of UP government was low due to less attainable. Further, relatively similar outlook was seen for NGOs and private companies. Under the project, interventions implemented were cultivation of forage crop based module and technology of round the year green fodder production. Further, livestock based module were mineral supplements for anoestruscows/buffaloes, response of mineral mixture supplementation in lactating cows/buffaloes, strategic supplementation in ration of goat/sheep. Apart from these, there were modules based on enterprise for generation of employment, capacity building and development of extension aids. Functioning of several Self Help Group (SHG) like Shri Ramraja Sarkar Unnatisheel Krishak Samuh, Maa Harshidhhi Krishak Samuh and Khati Baba Krishak Samooh etc. were also observed in the cluster of village. Five farmer's libraries for furnishing information to rural households related to advanced technology and farming practices are organized. SHG in every village maintain the library. Propagation of the research outputs which is feasible for the adoption and execution by the farmers was performed by the way of various schemes like Farmer to farmer, mass media system, development of extension material, interaction and distribution of literature, cross-visit, meeting in the field and project site meetings. Vermicompost unit at Ganeshgarh and Adarsh Chara Gram were organized under Farmer to farmer exchange in the project village. Raising of Bundelkhandi goats were promoted among the goat keepers owing to lower adaptation capacity of goats from other tracts. Distribution of bucks of Bundelkhandi, Jakhra and Sirohi breeds having high genetic merit was implemented and scrub bucks were castrated concurrently. Because of adoption of health care practices like vaccination and deworming, outbreak of infectious diseases was not noticed in the villages under investigation. In other villages about 20-55 per cent mortality was found among the flocks. Pregnant, lactating and young kids were offered concentrate mixture. Drought tolerant varieties of fodder such as sorghum, oat and

perennial grasses were popularized as they can withstand adverse climate and can be sustained in rain-fed situation. Cultivation of legume fodder was also initiated there. Around 40-70 per cent production of fodder was found compared to traditional animal feed. High-yielding cattle and buffaloes were more exclusively offered sown fodder. Cost effective shelters, feeder and water trough were bestowed to the beneficiaries. To support goat farmers for acquiring of better price, facility of goat market was established through KSS with the assistance of Tata Trust. A kid nursery was constituted to develop genetic potential of Bundelkhandi goats. Insurance cover was provided to the goat keepers. Sustainance of cold storage, vaccination facility, micro-credit and CPR has to be assured to facilitate adoption of interventions in long run (Singh et al., 2013). Livestock production is substantial supporter to the existence of poor households in the eco-fragile area (India Task Force, 1987); especially, small ruminants exhibit crucial job in assuring earnings to economically weaker section of society (Pasha, 2000).

A survey was undertaken in the watershed and control village in Bundelkhand region of MP, where it was observed that at least, one species of livestock owned by around 76-85% households. Large ruminants were mostly reared by large farmers whereas small ruminants by small and landless category of farmers. In both watersheds as well as control villages, small ruminants accounted 30% of total livestock holding. Relative number of cows (38 and 35%) were greater compared to buffaloes (16%) in both the groups (Mondal et al., 2014). While the number of bullock decreasing since few long back in both the watershed and control group due to high level of mechanization in farm activities (Subrahmanyam and Rao, 1995; Mondal *et al.*, 2014). Investment has been done remarkably on watershed-based model by the government for securing livelihoods in drought susceptible area. About 56.54 million ha of land was covered by virtue of different schemes till March, 2007 (Sharda et al., 2008). Currently, watershed development programmes (WDPs) have reformed to integrated and participatory approach to a greater extent from solely inclined Soil-Water Conservation (SWC) strategies for the purpose of linking natural resources management with the agencies. However, impact of the NRM programmes has been noticed to be noteworthy (Rao, 2000). Thus it results in increasing accessibility to ground water physically and commercially (Chandrakanth et al., 2004). Further, profitability of livestock associated implementations was propagated more evenly in contrast to land holding (Kurup, 2003; IWMI, 2005). Majority of watershed model is particularly targeting on “mixed crop-livestock farming system” under versatile environmental conditions. Moreover, the interventions based on land and conservation of water resources lead to increase in vegetation cover, availability of drinking water and decrease feed scarcity of the livestock.

- 8. Meteorological Obstacles:** In Bundelkhand, agriculture farming is diversified, heterogeneous, risky and rainfall dependent. About 850 mm rainfall was observed in the region during 2011–17 (IMD 2018). In the current years, extreme climatic condition such as flooding, short-term rain and dry weather added to uncertainties in farming leading to elevation of poverty. Furthermore, deficiency of water, poor soil fertility with low productive capacity exacerbates complication of food security (Rathod and Dixit, 2020). According to report there is limited facility of irrigation, deficiency of quality seed, fertilizer, weed problem, insects pest and disease prevalence in crops, and higher investments in farming practices (FFP, 2018). Meteorological variables such as temperature,

humidity and rainfall induced 52 and 84% seasonal variation in Foot and Mouth Disease (Ramarao, 1988). As a result of drought, animals suffer from heat stress, leading to dehydration which subsequently causes low milk production and sometime death of livestock. Moreover, decrease in rainfall results in limited pasture growth and might causes decline in crop residues. The livestock lose weight and majority of them die due to deficiency of fodder (Siemes 2008; Van den Bossche and Coetzer 2008; Rathod and Dixit, 2020). Pattern of rainfall is altered due to change of global environment (Fiala et al., 2009). As per the report of a macro-scale water balance model, world-wide increase in water demand due to climate change can be expected by the year 2021–2030 (Tao et al., 2003). Fluctuation in temperature and rainfall results in alteration of CO₂ concentration which might causes serious outcomes (Lawlor, 1998). Total dry matter intake and milk yield declined in Haryana cow because of rise in temperature (Lal et al., 1987). Similarly, increase in temperature and relative humidity resulted in decrease productivity of Sahiwal cattle (Mandal et al., 2002). Majority of the farmers combat with drought by acquiring strategies like preliminary storage of wheat straw and crop residues (mustard/ linseed/ gram/lentil etc.) to cover insufficiency of feed. Stored feed like crop byproducts and tree leaves are offered to the animals during drought. Most of the dairy farmers stated that at the time of water scarcity, community ponds were filled with the help of governmental tube-well for the supply of drinking water to the livestock (Sankhala et al., 2016).

- 9. Opportunities and Future Prospect:** Great scope exists for improvement of animal husbandry in the region. Livestock owners are not aware of different advanced system of livestock production. Modern system of livestock raising and genetic improvement programme need to be familiarized among the community in order to enhance genetic potential of the animals and boost up productivity. Establishment of adequate facility for cold storage, value addition, processing of animal products and structured marketing including export is prerequisite. Nearly 70 per cent of the rural farmers in India are pursuing livestock farming and majority is landless, marginal and small households. Distribution of livestock sector is more uniform compared to agriculture (Taneja and Birthal, 2004). In forthcoming period, demand for animal products would enhance because of faster growth rate of India's population, also economically strong section of society has more inclination toward animal source of nutrients which accelerate development of livestock sector (Planning Commission, 2012). Furthermore, the animal husbandry was scrutinized by Government of India to attain the target of doubling farmers income (Chand, 2017; Das and Kumar, 2019). Immense opportunity lies for uplifting rural households through livestock sector.

Among livestock components, dairy production and goat farming are important for the entire region. Creation of fodder bank and fodder block manufacturing units requires attention for assuring availability of plenty of feed and fodder in the Bundelkhand Region. Pronounced efforts are needed for magnification of network for dairy cooperative, processing opportunities and increasing milk availability (Rathod and Dixit, 2020). Enormous probability arise for rejuvenating carrying capacity of grazing resources to encourage worthier livestock production (Anonymous 2008). In this area, low and unproductive non-descript animals should be reduced. This can be attained by preventing indiscriminate natural breeding among the livestock. Scrub bulls must be inscribed and extensive castration scheme of non-descript male animals should be practiced. Moreover, farmers should be provided incentive and subsidy to keep

productive animals. For enhancement of production potential, high yielding livestock need to be introduced in the region and widespread grading up of local livestock should be strengthened. Replacing traditional system of feeding by providing total mixed ration /complete feed blockswould be a better option. Likewise, instead of free-range grazing, small ruminants should be stall fed. Feed processing techniques like preparation of total mixed ration has to be developed. Scrutiny of trained personnel for AI and vaccination programme is very essential. Perceptive camp and training programme has to be organized for the village peoples. Extension services need to be invigorated to educate the farmers in order to terminate Anna Pratha system of livestock raising. Preference is to be given towards capacity development of all the stake holders (Samra, 2008).Enthralling youngsters and poor households towards agricultural sector via capital generating entrepreneurship is the demand in subsequent time (FFP, 2018).Reinforcement of extension system concerned with livestock farming is required because of lack of proper linkage between different organizations engaged in various activities for the development of livestock sector. Intercommunication amongst multi-stakeholders by the way of feedback principle is essential to constitute policy articulation in future(Chander and Rathod, 2015;Rathod and Dixit, 2020).

III. CONCLUSION

Education gap among farmer about technologies, inefficient veterinary facilities, feeble housing structures, higher management cost andlack of credit are various restriction in Bundelkhand region. Encouragement of dairy farmers about modern system of livestock farming, value addition, genetic improvement of animals, cultivation of nutrient rich fodder with improved variety of seeds is essential through awareness camp and extension programmes so that reproduction and production potential of the livestock can be enhanced.On the other hand, diminishment of various constraints in the path of livestock development can be achieved by sustainable execution and maintenance of common property resources. Moreover, veterinary facilities, periodical training programme and livestock survey are another important attribute for rectification of livestock farming. Substantial attempts are required for the effective performance of livestock sector at the edge of policy planner, extension worker and various stakeholders in this undulated and eco-fragile domain. Watershed implementing agency has to focus exclusively on livestock improvement-based interventions as animal husbandry is crucial mainly in the region which is rainfed and prone to natural calamities as the enterprise act as coping strategies against economical risk. It is required to promote small scale operation of additional enterprise and capacity building amongst the farming community like backyard poultry, fishery, small dairy and goat unit, and beekeeping apart from agriculture. As these activities sum-up economy of rural household and safeguard against natural disasters. Financial support by the government is mandatory to encourage the farmers for rearing of livestock possessing high genetic potential to accomplish livelihood security of the rural population in Bundelkhand regionof India.

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