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Fodder status in drought year and the practice of free range grazing in Bundelkhand region of India

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ABSTRACT

Free range grazing of animals, is a practice followed since many years by farmers of Bundelkhand region of India which often leads to conflict in the community. Inadequacy of fodder is the main reason for this. Scientific analysis of fodder scenario in the region which comprises 13 districts of Uttar Pradesh and Madhya Pradesh using secondary data of crops, livestock and land use pattern was carried out so that districts with severe shortage of fodder get priority in livestock development projects. Besides, primary data was collected from 43 farmers to know the reasons for practicing it. Results indicated that 3 districts Tikamgarh, Jhansi and Jalaun belonged to deficient and 4 districts-Mahoba, Hamirpur, Banda and Chitrakoot were in severely deficient dry matter categories. Region faces dry matter shortage of nearly 42%. In all the districts, contribution of crop residue to total dry matter was more. However contribution of greens and concentrate did not vary much and remained almost same across districts. Analysis of primary data revealed that 67.44% of farmers in the region follow the practice of free range grazing. Majority (62.79%) expressed shortage of fodder and water for livestock in summer as the main reason to follow this practice. Establishing cattle shelters during summer in villages was suggested by 67.44% of farmers to restrain from following this practice. Convergence of efforts of different agencies and farmers is required to promote agri-horti-silvipastoral system for sustainable fodder availability in the region.

Keywords: Convergence, Crop residue, Dry matter availability, Farmers, Livestock

Indian agriculture without livestock can't be a reality sooner or later. Farm input market is flooded with varied types of fertilizers prepared from numerous chemical formulae/composition/molecule. Availability of these, never encouraged farmers to defer livestock rearing. Prevailing climate, soil types, cropping pattern, socio-economic configurations, etc convince farmers to continue to use farmyard manure to the extent making livestock rearing inevitable for them. Livestock indeed indirectly rules Indian agriculture. Livestock rearing is interwoven so deeply in farmers' lives that, farmers' evolve unique mechanisms to cope with related challenges.

'Free range grazing' locally called as '*Anna Pratha'* is one such mechanism that has evolved and being practiced in Bundelkhand, the driest region of the country. In this practice, animals are let loose by owners to graze in any land including cropped land of other farmers. This has become a sort of menace and government is finding it difficult to curtail this practice.

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Crop residue basically forms main feed source of livestock. However failure of crops due to frequent drought in the region challenges availability of crop residue for livestock. This is when farmers resort to free range grazing. Among natural calamities, drought is considered as severe one as its effects are prolonged ones. Floods, whenever and wherever they occurred, were often considered welcome phenomena despite some losses because they recharged ground water and renewed soil fertility (D'Souza 2002, Singh 2008). Frequent droughts in Bundelkhand region brings in varied difficulties as crop production, livestock rearing and seasonal out-migration provide more than 90% of rural income in Bundelkhand region (Samra 2008). In this region there have been 30 years (out of the last 50) with rainfall below normal, and 15 years, when rainfall was lower by more than 25% of the normal (Murty *et al.* 2013, Jain *et al.* 2014). Crop failure due to drought restricts availability of crop residue thus making rearing of livestock most difficult to farmers. Given this situation, farmers are left with only option of leading their livestock for free range grazing. This system however has off late become bone of contention, drawing attention of many technologists, administrators and policy makers. This, many times is the source of conflict in the community besides forcing other farmers (with irrigation facility) not to cultivate their fields during summer season. It had been estimated by a survey

that during three months of peak summer 300 thousand cattle and other animals died due to fodder and water shortage in the region. Several reports have discussed about the practice of free range grazing and situations forcing farmers to follow it. Most of these reports are based on observations and discussions with the farmers of the region. These reports however aptly reflected plight of farmers and livestock in the region but many times are very general and failed to convey based on scientific facts.

Bundelkhand region is spread in Madhya Pradesh and Uttar Pradesh, covering totally 13 districts. All these districts face frequent droughts but its impact vary across these districts as is influenced by many other factors like cropping intensity, livestock numbers, availability of common lands, etc. The varying impacts within the region need to be addressed to delineate the most affected one by understanding the fodder situation in different districts of Bundelkhand especially during drought year. Hypothesis is that district with the most acute shortage of fodder in Bundelkhand faces higher conflicts due to the practice of free range grazing. It is therefore essential to scientifically identify the districts in the region with the acute shortage of fodder to resolve conflicting situation and to prioritize them for suitable technological interventions to reduce the emanating effects. The situation thus calls for understanding systematically prevailing fodder situation specifically in this region and socio-technical alternatives (convergence model) that can be used to curb this practice to the extent possible. Objectives of analysis for the present research paper are to Quality–categorise districts of Bundelkhand based on fodder availability in drought year, assess contribution of different sources to the dry matter availability to livestock and comprehend measures for interventions to improve the fodder scenario on sustainable basis in the region.

MATERIALS AND METHODS

Bundelkhand located between 23°20′ and 26°20′ N latitude and 78°20′ and 81°40′E longitude (NGSI, 1989) comprises 13 districts of two states. Jhansi, Jalaun, Lalitpur, Hamirpur, Mahoba, Banda and Chitrakoot are 7 districts of Uttar Pradesh and Datia, Tikamgarh, Chattarpur, Damoh, Sagar and Panna are 6 districts of Madhya Pradesh, together forming Bundelkhand region. The region experiences hot and semi-humid climate. The mean annual precipitation varies from 75 cm in the north to 125 cm in the south east part. Agricultural drought of various intensity is common phenomenon in the region. About 50% of geographical area of Bundelkhand is cultivated and rest is categorized under various other land uses. Chickpea, wheat, sorghum, paddy, maize, barley, lentil, sesame, mustard, groundnut, soybean, peas, blackgram, greengram, vegetables and fruits are the most important crops cultivated (Anonymous 2016). About 6.5% of its total land was available for grazing.

Secondary and primary sources of data were consulted for the study. Free range grazing is practiced largely in drought year. So the most drought affected year of Bundelkhand between 2010–2019 was chosen for the study. Severe drought year of the region was the year 2015–16 with rainfall deviation of 41%. So, district wise and year wise data on crop production and land utilization for the year 2015–16, as is the year of drought, were obtained from Economics and statistics division, State Planning Institute, Planning Department, Uttar Pradesh and Madhya Pradesh state.

This data was used to analyze fodder status of the region reflecting on the type of feed resources available and their quantities by following the methodology suggested by Anandan and Sampath (2012). They proposed using harvest indices for crop residues and oilcakes and extraction rates for grains and bran/husk of different crops to obtain feed availability from crops. Average green fodder production for different land use categories was arrived at as per Ramachandra *et al*. (2007) with slight modification (indigenous cattle above 3 yrs given 1 factor instead of suggested above 2.5 years). District wise livestock population data based on the livestock census 2012 was collected and estimated livestock population for the year 2015–16 was arrived at by computing the compounded annual livestock growth rates for 2007 to 2012. Per cent change in livestock number (2007–2012) in Uttar Pradesh was 14.01, and –10.72 in Madhya Pradesh. Age wise data of cattle, buffaloe, goat and sheep was converted into Adult Livestock Units (ALU). Hence, three sets of data of 2015–16 on crop production, land utilization and livestock numbers were considered for the study. Average dry matter content of crop residues was computed at 90% and greens was computed at 25%. Requirement of dry matter for livestock units of a district was worked out considering 7 kg of dry matter per day per ALU (Anandan and Sampath, 2007). Estimated dry matter availability was worked out by combining data from 22 crops and land use. The difference between dry matter availability and requirement was converted into percentage of dry matter availability for every district of Bundelkhand based on which districts were classified into five groups as surplus (>100% DM availability), sufficient (80–100% DM availability), moderately sufficient (60–79% DM availability), deficient (40–59% DM availability) and severely deficient with less than 40% DM availability (Biradar and Vinodkumar 2013). DM availability from each source; crop residues, greens (land use) and concentrates (grains and brans/chunis) was converted into percentages to assess their contribution to the total DM availability in each district. Besides primary data from 43 farmers of 3 villages—Behta, Padri and Keshavpur of Jhansi district was elicited using questionnaire on their free range grazing practice and reasons and suggestions to address this practice effectively. Consultation to different literature, expert discussions and experience of authors were used to develop conceptual holistic model for interventions to eventually weaken the practice of free range grazing in Bundelkhand.

RESULTS AND DISCUSSIONS

Distribution of livestock in different districts of

Bundelkhand: Districts belonging to Bundelkhand region of Uttar Pradesh (UP) had more livestock (together nearly 56%) as compared to its Madhya Pradesh (MP) districts (44%). Among all the districts, Sagar had highest share (10.86%) followed closely by Jhansi (9.34%) and Banda (9.21%). Datia district of Madhya Pradesh however had least number of livestock, the share of it to total livestock of Bundelkhand being only 3.39%. Datia is geographically smallest among 13 districts of Bundelkhand which could be the reason for less number of livestock (Table 1).

Classification of districts in Bundelkhand based on extent of estimated DM availability to the livestock: Out of 13 districts of Bundelkhand, only Datia of Madhya Pradesh (MP) belonged to surplus category of dry matter availability (Table 2). Presence of less number of livestock in this district would have influenced this finding. Chhatarpur district belonged to sufficient dry matter category. This particular district had large area under wheat, barley and sorghum among cereals and blackgram, green gram and groundnut among pulses and oilseed. District also witnesses good production of Soyabean. Hence production of crop residues especially fine straw was more in this district thus enabling it to have sufficient dry matter for livestock. Four districts Panna, Sagar, Damoh and Lalitpur were in moderately sufficient category. However 7 districts, little above half of districts of Bundelkhand belonged to deficient dry matter category, among which three (Tikamgarh, Jhansi and Jalaun) were in deficient and four (Mahoba, Hamirpur, Banda and Chitakoot) were in severely deficient categories. Notable finding was that almost all the districts of Uttar Pradesh's Bundelkhand were in deficient category except Lalitpur while only one district Tikamgarh of Madhya Pradesh's Bundelkhand was in deficient category and its other districts remained in higher categories. All four districts of severely deficient category were from Uttar Pradesh part. In MP Bundelkhand, percentage of total irrigated land is higher than the state average, at nearly 40% of total sown land. This could be the reason for many districts sufficiently having dry matter. Despite of availability of irrigation, yield of many of the crops in MP Bundelkhand is low due to factors such as soil quality, use of fertilisers and seed replacement rate (Samra 2008). High drought intensity was reported for Datia, Jhansi and Hamirpur districts. Overall, the agricultural vulnerability was found to be extreme in Datia, Jhansi and Hamirpur followed by severe in Tikamgarh and Banda districts (Samra 2008). All these drought vulnerable districts are either in deficient or severely dry matter deficient categories, except Datia as is endowed with less number of livestock.

Table 1. Distribution of livestock in different districts of Bundelkhand

District	Total ALU ('000 no.)	Percentage
MP-Sagar	652.472	10.86
UP-Jhansi	561.359	9.34
UP-Banda	553.217	9.21
UP-Lalitpur	521.809	8.68
MP-Tikamgarh	486.300	8.09
MP-Chhatarpur	476.086	7.92
UP-Jalaun	472.847	7.87
UP-Hamirpur	466.671	7.77
UP-Chitrakoot	448.133	7.46
MP-Damoh	446.272	7.43
MP-Panna	388.394	6.46
UP-Mahoba	331.575	5.52
MP-Datia	203.821	3.39
UP Bundelkhand	3355.611	55.84
MP Bundelkhand	2653.350	44.16
Bundelkhand	6008.960	100.00

UP, Uttar Pradesh; MP, Madhya Pradesh; ALU, Adult livestock units.

Table 2. Categorisation of districts of Bundelkhand based on extent of dry matter availability

Category	Criteria (DM availability)	District	No of districts
Surplus	More than 100%	MP-Datia	1
Sufficient	80–100%	MP-Chhatarpur	1
Moderately sufficient	60–79%	MP-Panna, MP-Sagar, MP-Damoh, UP-Lalitpur	4
Deficient	40–59%	MP-Tikamgarh, UP-Jhansi, UP-Jalaun	3
Severely deficient	<40%	UP-Mahoba, UP-Hamirpur, UP-Banda, UP-Chitrakoot	4
Mean			57.98%
SD			27.85%

Mean dry matter availability in Bundelkhand region was only about 57.98±27.85%, indicating dry matter shortage of nearly 42% (Table 2). Singh *et al.* (1997) reported that in the region there was a substantial gap of demand and supply of dry matter, of about 31%. Even after two decades of reporting this finding, Bundelkhand continues to face more dry matter shortage because of prevailing agro-ecological factors.

Contribution of different sources to the total DM availability in Bundelkhand: In all categories of districts, contribution of crop residues surpassed contribution from greens and concentrates (Table 3). In surplus category, crop residue contributed for 103.51% of which nearly three fourth of it came from fine straw. Its contribution was 49.14% in sufficient, 43.85% in moderately sufficient, 39.08 in deficient and 22.97% in severely deficient categories. In all categories, share of fine straw was more followed by legume straw. Coarse straw share was lesser than even sugar cane tops. Fine straw yielding barley, wheat and paddy are major cereal crops of Bundelkhand while jowar and maize, crops of coarse straw are cultivated less. A variety of legumes like blackgram, greengram, etc are cultivated in large areas of Bundelkhand. Legume straw enriches crop residue. Its share is encouraging in all categories as is next only to fine straw. In surplus category its contribution was 21.84% and in other categories its contributions were 13.16% (sufficient), 18.77% (moderately sufficient), 19.32% (deficient) and 7.54% (severely deficient). UP

Table 3. Source-wise per cent DM availability in different categories of Bundelkhand districts

Feed source	Districts' categories					Bundelkhand
	Surplus	Sufficient	Moderately sufficient	Deficient	Severely deficient	
Crop residues						
Coarse straw	1.34	1.29	1.50	1.51	3.07	1.79
Fine straw	76.49	34.65	23.56	18.14	11.88	21.31
Legume straw	21.84	13.16	18.77	19.32	7.54	16.61
SC tops	3.84	0.05	0.02	0.11	0.48	0.22
Total CR	103.51	49.14	43.85	39.08	22.97	39.93
Greens						
Gross Cropped area	4.98	6.46	7.130	5.140	2.710	5.580
Forests	2.12	6.6	6.870	1.270	0.860	3.840
Pasture	1.45	7.32	3.045	0.644	0.044	1.892
Current fallow	0.2	0.4	0.150	0.290	0.290	0.240
Other fallow	0.22	0.424	0.155	0.203	0.113	0.177
MTC	0.191	0.004	0.007	0.022	0.134	0.039
Culturable waste land	0.823	0.765	0.544	0.260	0.212	0.407
Total greens	9.98	21.98	17.91	7.830	4.360	12.170
Concentrates						
Grains	1.71	0.83	0.54	0.45	0.34	0.51
Brans & chunis	5.98	2.75	2.00	1.43	0.89	1.73
Oilcakes	4.08	3.99	3.66	2.51	0.55	2.73
Total concentrates	11.76	7.57	6.20	4.39	1.78	4.98
DM availability	126.96	79.52	68.51	51.75	29.44	57.98
kg/ALU/day	8.89	5.57	4.80	3.62	2.06	4.03

All figures indicate percentages.

Bundelkhand is predominantly a pulses-growing area. On the contrary in Karnataka leguminous straw contributed only 6.89% (Biradar and Vinodkumar 2013). Composition of crop residue is evidently depends upon the cropping pattern being followed in the region. The fractioning of crop residue however assumes importance in terms of residue management practices while storing and feeding livestock. Chopping coarse straw while feeding significantly reduces wastage but fine straw is more amenable for baling and preserving. Crop residues contribute on an average 40–60% of the total dry matter intake per livestock unit in India. Considerable regional variation in the dominant type of crop residue is noticed with hay of leguminous crops dominating in the drier regions (Rao and Hall 2003).

Gross cropped area contributed more among sources of green fodder in all the five categories. Compared to other categories its contribution though cannot match with the crop residues but tops in the districts of moderately sufficient category. In summer, farmers practice free range grazing after the harvest of crops. These unfenced lands because of this particular practice are not being cultivated even by those having irrigation facility which is the matter that needs to be addressed. Greens from land use categories contributed nearly one fifth (21.98%) to the total dry matter availability in sufficient category. Chhatarpur district compared to other districts of Bundelkhand has more pasture and forest land resulting in its higher share.

Contribution of concentrates to the total DM availability ranged from 11.76% in surplus category to 2.06% in severely deficient category. Except greens, crop residues as well as concentrates availabilities were influenced by cropping pattern. Various factors like land, weather, use of modern varieties, opportunities for market, animal ownership pattern, etc. do influence cropping pattern.

Mean dry matter availability in surplus district was 127% and in sufficient district was 79.52%. The same in moderately sufficient, deficient and severely deficient districts was 68.51%, 51.75% and 29.44%, respectively.

In all the districts, contribution of crop residue to total dry matter was more (Fig. 1). However contributions of greens and concentrate did not vary much and remained almost same across districts. Crop residue explained 80% of variation in dry matter availability across different districts of Bundelkhand. This indicates that data on production of crop residues predicts the extent of availability of dry matter in the region. But its reported that while agriculture is the predominant occupation in Bundelkhand, land available and used for cultivation in the region is considerably lower than in other agriculture zones of the country. The large area of wasteland in the Bundelkhand and the percentage of land used for cultivation is less, to around 50% in Chitrakoot and Lalitpur districts, and less than that in Chhatarpur, Tikamgarh and Damoh districts; in Panna, only around 35% of total area is cultivated. In Sagar and Datia districts, the percentage is around 53 and 67 respectively.

Details of free range practice followed by livestock

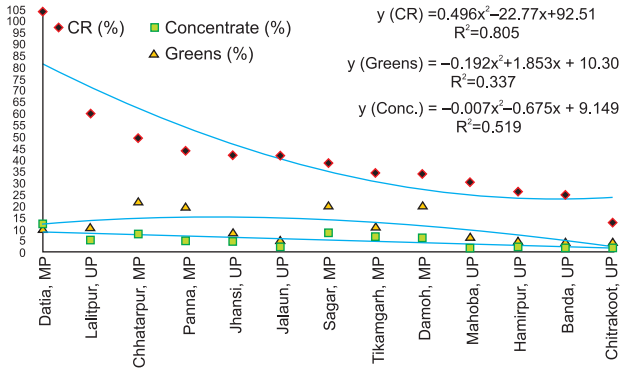

Fig.1. Trend showing contribution of different DM sources across districts of Bundelkhand.

farmers: Analysis of primary data revealed that 32.56% farmers were not following free range grazing but the remaining farmers are practicing it since less than 10 years (9.3%), 10 to 20 years (32.56%), 20 to 30 years (11.63%) and more than 30 years (13.95%). Similarly 37.21% of farmers did not send any cattle to free range grazing in previous year. However amongst remaining per cent of farmers, 4.65% sent only 1 cattle, 39.53% sent 2 cattle, 2.33% sent 3 cattle and 16.28% sent 4 and more than 4 cattle to free range grazing in 2017–18.

Majority (62.79%) expressed that shortage of fodder and water for livestock as the main reason to follow this practice (Table 4). This was followed by other reasons like it saves time and labour (13.95%), dry animals can be sustained on stubbles grazing in harvested fields (9.30%) and this practice helps for natural crossing of cows (4.65%). Major problems of this practice expressed by farmers were-damage to standing crop (65.12%), cause of conflict between farmers (20.93%), chances of loosing cattle (9.3%) and loss of dung (6.98%). Suggestion given by majority farmers (67.44%) to counter this problem was to provide cattle shelter (Goushala) during summer months to villagers. Government should ensure availability of fodder and water during summer months for livestock was suggested by 37.21% interviewed livestock farmers. Other suggestions were to create better employment opportunities for unemployed rural youths (9.30%) and create market facility to buy or sell cattle during summer (6.98%).

Livestock rearing is an important income generating activity for farmers of Bundelkhand region. Making fodder available to farmers of the region is very important to supplement income levels of these farmers. Efforts to address the issue of fodder deficiency must begin in a phased manner by first covering severely deficit (Mahoba, Hamirpur, Banda and Chitrakoot) and deficit (Tikamgarh, Jhansi and Jalaun) districts. These districts form more than 50% districts of Bundelkhand region. Interventions like promoting dryland horti-pasture system, opening cattle shelters and farm ponds should be taken up to address the issue of fodder shortage in the region.

Table 4. Reasons for following free range grazing, problems due to it and suggestions to address as expressed by farmers

Particular	No.	%
Reason		
Shortage of fodder and water in summer	27	62.79
Saves time and labour	6	13.95
Dry animals can be sustained on grazing stubbles in harvested field	4	9.30
Allows for natural crossing of cow	2	4.65
Problem		
Damage to standing crop	28	65.12
Cause of conflict between farmers	9	20.93
Higher chances of loosing cattle	4	9.30
Loss of dung	3	6.98
Suggestion		
Provide cattle shelter (Gowshala) for 2 to 3 villages together during summer months	29	67.44
Government should ensure availability of fodder and water to livestock in summer	16	37.21
Create better employment opportunities for unemployed rural youths in the region	4	9.30
Market facility should be created to buy and sell cow in summer	3	6.98

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