Livestock diversity among the sedentary and transhumant pastoralists: a case study from rajouri district of jammu and kashmir

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Abstract-
BACKGROUND AND OBJECTIVES: Diversification can occur in two ways, horizontal and vertical. But the present study assessed the horizontal diversification of livestock species based on data availability. So far crop diversification, economic diversification, agricultural diversification, livelihood diversification etc., has gained enormous attention worldwide but to some extent the work on livestock diversification is ignored. The present study focused on the livestock diversification among the sedentary and transhumant Gujjar and Bakarwals of the study area.
METHODS: The study used a descriptive research method to analyse the livestock diversification based on the primary data. For the present study Rajouri district of the Jammu and Kashmir has been taken as the study area. The district consists of nineteen blocks, and multi-stage sampling techniques have been applied to collect the data. In order to assess the livestock diversity, Shannon-Weiner Diversity Index is used.
FINDING: The study demonstrated that the sedentary/semi-migrants' pastoralists having the highest proportion of goats (30.5 per cent) and buffaloes (30 per cent) followed by the sheep (25 per cent), cow (7.9 per cent) and oxen (4.6 per cent) population. While the proportion of livestock species found among the transhumant pastoralists are goats (52.8 per cent) and sheep (40.4 per cent) followed by the buffaloes (3.10 per cent) and horse (1.87 per cent). The proportion of cows and oxen population is found less in the transhumant pastoralist's livestock units. In contrast, the proportion of horses and mules is fond least in the sedentary pastoralist's livestock units. This variation is due to the fact that the transhumance prefers to possessed horses and mules with their main livestock species to transport their luggage from one location to others at the time of their seasonal migrations, but on the other hand sedentary pastoralists prefers to possessed oxen for ploughing and threshing purposes.
CONCLUSION: The study discovered that sedentary pastoralists' livestock diversity is more than 10 per cent than that of the transhumant livestock unit. Special attention should be paid to encourage the tribal pastoralists for diversifying their livestock. Livestock diversity minimize the risk of loss of livestock by various extreme events and also maximize the benefits from their livestock. In addition to economic gain, diversifying livestock units allows for a more comprehensive exploitation of various grasses, herbs, shrubs, and plant species, as different animals require different kinds of feed, and at the same time, it lesser the pressure on a single forage species and balance the ecosystem.

Key words: **Livestock Diversity, Transhumance, Sedentary, Pastoralists, Gujjar & Bakarwals.**

Introduction

Diversification is a term with multi-layered meanings that are understood differently depending on the context. When applied at the national level, for instance, it typically signifies a structural transformation consisting of a redistribution of resources, especially labour, from agriculture to industry and services (**Joshi, et al., 2004).** The root of the word 'diversification' is 'diverge,' which means to move or extend in a different direction from a common point. Since diversification is the antithesis of concentration in this sense, most techniques for evaluating diversification probably have ended up measuring concentration instead. Diversification, in economics, is the representation of a situation in which the share of several activities in a system either increases or decreases relative to the share of the dominant activity. Applying the same logic to farming, an increase in the relative contribution of many commodities to agricultural income may be called income diversification in agriculture, while an increase in the relative contribution of many crops to the withdrawal of a resource may be called resource diversification in agriculture. Therefore, concentration ratios can be used to evaluate levels of diversification (**Jha, et al., 2009).** In a nutshell, livestock diversification means how many numbers of different livestock species are reared in a habitat. There are two types of agricultural diversification, i.e.,

horizontal and vertical. But in the case of transhumant pastoralists, it is observed that there is only horizontal diversification but vertical diversification is least found due to their migratory and traditional mode of livestock rearing**.** In general, the greater the dominance of one crop over another in a given areal unit, the lower the crop diversification, and vice versa **(Bhatia, 1965).** In general, increased diversity leads to greater flexibility because it opens up more opportunities for substitution between shrinking and growing opportunities. This makes it easier to take advantage of both expanding and shrinking opportunities. Reducing vulnerability to stresses and shocks is one way diversification helps ensure livelihoods' long-term viability. There are two possible environmental benefits to diversification. One way is to increase the quality of the resource base by investing the money that is generated. The second is to provide alternatives to exploiting natural resources, such as making gathering activities in forests less profitable **(Ellis, 2000).** Horizontal and vertical diversification are the two primary types of diversification. Expanding the number of crops grown in a given area is an example of horizontal crop diversification. Simply by growing more crops in the same space and employing management strategies like multiple cropping and other forms of resource conservation, the system's foundation can be widened **(Banerjee, & Banerjee, 2015).** The term "vertical diversification" is used to describe the practise of growing the most profitable crop and then using that crop in other ways to increase overall profits. The farmer who milks their cows to produce cheese and butter **(Doane, 1944),** and in other words it is expressed as the use of any crop species that can be processed into finished goods for instance canned processed into juices or syrups **(Banerjee, & Banerjee, 2015).**

As a result of raising more varieties of livestock, the ecosystem's multifunctionality was greatly enhanced. It has always been the case that the connection between multi-diversity and ecosystem multifunctionality is stronger than the connection between individual components of diversity and their respective functions. Adding even two species of livestock greatly and noticeably raises the above-ground diversity, multi-diversity, multifunctionality, and weighted ecosystem multifunctionality. Animals like cattle and sheep, which have very different feeding habits and preferences, may have a synergistic and complementary effect on plant community structure. Moreover, compared to farms with only one type of livestock, farms with a more diverse livestock population may offer a greater variety of niches for insects and soil organisms, such as by increasing the variety of animal dungs and plant litter **(Wang, et al., 2019).** The availability of labour positively affects livestock diversification. Another reason for livestock diversity is the resistance of species to drought conditions, the rate of reproduction of the species and pastoralists also preferers those species that can be sold out during severe drought. Geographical locations also affected the livestock diversification **(Boru, et al., 2014).** Livestock diversification is a significant strategy herds adopt to cope with changing climate and rangeland conditions. Different livestock species are kept to fulfil household subsistence priorities above other production goals of the herders. Multispecies herding would therefore seem to be a prudent local adaptative strategy to improve resilience to climate and rangeland cover changes through enhancing existing practices' adaptive capacity (**Megersa, et al., 2014).** When paired with substantial infrastructural facilities, financial and technological support, crop diversification has the potential to be a socially beneficial policy **(Chakrabarti & Kundu, 2009).** Food security and income generation for resource poor farmers, as well as environmental protection, can benefit from increasing diversification (of locally adapted or introduced novel varieties and related production systems) to reduce risk related to climatic and biotic vagaries, particularly in fragile ecosystems and commodity fluctuations **(Banerjee, & Banerjee, 2015).** Agricultural diversification is proposed as a solution for achieving food security and sustainability in intensified agriculture, but widespread policy implementation is lacking **(He, et al., 2022).** The multiple socioecological challenges of life on these lands have historically favoured pastoral livelihoods based on extensive livestock herding **(Dong et al., 2011).** A primary concern for pastoralists is not fixed control of a particular parcel of land with variable forage production, but rather flexible access to a variety of pastures during seasonally variable times of need. This is because the availability of forage changes throughout the year. Therefore, academics working in a variety of pastoral contexts all over the world have consistently concluded that activities for future development must be built on the foundation of the livestock economy rather than looking for ways to replace it **(Fratkin and Roth, 2005; Little, 1992; McPeak et al., 2012; Sandford, 1983; Lio, et al., 2015).** Diversifying means of making a living in northern Xinjiang has had little effect on residents' ability to raise their standard of living or income. Even when other options for making a living are available, well-off households are more likely to rely solely on pastoral production based on extensive livestock herding, while those with fewer resources will choose to diversify into less desirable livelihood strategies, resulting in even more extreme poverty. Some of the basic premises of the livelihood diversification theory may not be valid in the pastoral society of northern Xinjiang **(Lio, et al., 2015).** Most of the pastoral households in northern Xinjiang diversify their assets, incomes, and activities because they are forced to by unfavourable conditions, rather than because they are drawn to a higher standard of living **(Liao, Sullivan et al., 2014; Lio, et al., 2015).** Diversifying one's occupation typically necessitates decentralisation, which goes against the ethos of pastoralism and actually increases rather than decreases vulnerability. Livestock species diversification, in which browsers and grazers are mixed to take advantage of the rangeland's resources in complementary ways, is a more effective risk-minimization strategy in this context **(Lio, et al., 2015).** Pastoralists reduce their risk by diversifying their herds by keeping both large and small ruminants, grazers and browsers, in order to get the most out of their available resources **(Nori, 2007; Lio, et al., 2015**). So far crop

diversification, economic diversification, agricultural diversification, livelihood diversification etc., has gained enormous attention worldwide but to some extent the work on livestock diversification is ignored. A very few studies talk about the livestock diversification such as (**Megersa, et al., 2014; Boru, et al., 2014; Wang, et al., 2019,** cited in the study **Lio, et al., 2015**). It is common practise to advocate for diversification as a means to better the lives of rural poor. However, mobile pastoral communities may not benefit from policy recommendations for livelihood diversification based on evidence from crop-cultivating sedentary rural societies, as socio-ecological conditions predetermine livestock herding as the preferred livelihood strategy (**Lio, et al., 2015**). Livestock diversification can be equally beneficial as the diversity in others sources of livelihoods, in terms of reducing the risk from abnormal circumstances like droughts and other weather extreme events. In the fluctuating weather conditions species diversity based on the resistances can be the best response to stabilize the livelihood and reduces the losses. Moreover, very less study has been conducted to assess livestock diversification and there is not even a single study is found that discuss the diversification of livestock among the Gujjar and Bakarwals.

Database and Methodology

Primary data serve as the backbone of this investigation. The primary data was gathered through a comprehensive field survey using questionnaires schedule. For the present study Rajouri district of the Jammu and Kashmir has been taken as the study area. The district consists of nineteen blocks, and multi-stage sampling techniques have been applied to collect the data. Nineteen blocks of the district are being selected for the field study, within the developmental blocks purposively two villages have been selected base on the proportion of Gujjar and Bakarwals population and in order to select the sampled households within the villages simple random sampling techniques has been used. In order to assess the livestock diversity, Shannon-Weiner Diversity Index is used. Microsoft-Excel is used to calculate the Shannon Diversity Index.

The formula is as follows**;**

$$H = -\sum_{i=1}^{s} \text{pi ln pi}$$

[Nolan, & Callahan, 2006; Liao, et al., 2015].

Where H' is the species diversity index, s is the number of species, and pi is the proportion of individuals of each species belonging to the ith species of the total number of individuals.

Study Area

Rajouri district of Jammu and Kashmir has been taken as the study area; it lies between the geographical coordinates of 32°58′ and 33°35′ north latitude and 70°00′ to 74°40′ east longitude. The proportion of Gujjar and Bakarwals population is 36.24 per cent to the district's total population, making it the district with highest concentration of Gujjar and Bakarwals population among all the districts of Jammu & Kashmir. Gujjar and Bakarwals are the third largest ethnic group which constitutes 11 per cent to the total population, while the Rajouri district is home to 18.26 per cent of the total Scheduled Tribe population of Jammu & Kashmir.The district has an area of 2630 sq. km **(Taufique & Ikram, 2020).**

Finding and Discussion

TABLE 1: LIVESTOCK DIVERSITY INDEX AMONG THE SEDENTARY PASTORALISTS

Name of the Developmental Blocks of the District	Name of the Sampled Species							Pi ln pi = (H)
	Goats	Sheep	Buffaloes	Cows	Oxen	Horses	Mules	
	Proportion (pi)							
	Pi	pi	pi	pi	pi	pi	pi	
Budhal	0	0.531	0.25	0.125	0.062	0.031	0	1.224
Koteranka	0.37	0.2	0.21	0.1	0.07	0.05	0	1.584
Kalakote	0.328	0.279	0.261	0.045	0.069	0.009	0.006	1.474
Dhangri	0.402	0.149	0.368	0.063	0.011	0.003	0.003	1.277
Siot	0.508	0.271	0.186	0.034	0	0	0	1.126
Khawas	0.146	0.448	0.241	0.052	0.103	0	0.009	1.413
Sunderbani	0.584	0.107	0.206	0.065	0.037	0	0	1.18
Lamberi	0.497	0.34	0.099	0.026	0.031	0.005	0	1.175

Darhal	0.517	0	0.448	0.034	0	0	0	0.817
Moughla	0.151	0.288	0.315	0.157	0.075	0	0.014	1.552
Doongi	0.394	0.22	0.259	0.071	0.047	0	0.009	1.42
Palanger	0.261	0.403	0.239	0.075	0	0	0.022	1.338
Nowshera	0.138	0.207	0.436	0.184	0.011	0	0.023	1.41
Qila-Darhal	0.186	0.078	0.575	0.149	0	0.006	0.006	1.175
Seri	0.274	0.193	0.29	0.209	0.032	0	0	1.47
Manjakote	0.165	0.319	0.351	0.082	0.062	0	0.021	1.487
Rajouri	0.09	0.46	0.25	0.095	0.04	0.025	0.04	1.494
Panjgrain	0.201	0.151	0.432	0.05	0.137	0.007	0.022	1.512
Thanamandi	0.102	0.245	0.469	0.02	0.122	0.02	0.02	1.428
District's Total	0.305	0.251	0.30	0.079	0.046	0.007	0.01	1.497

Source: Field Survey, 2021-22

Pastoralists reduce their risk by diversifying their herds by keeping both large and small ruminants, grazers and browsers in order to get the most out of their available resources **(Nori, 2007; Lio, et al., 2015**). As far as the present study area is concerned, among the livestock species kept by the sampled sedentary and semi-migrants' pastoralists are primarily buffaloes, cows, goats, and sheep, with a few oxen, horses, and mules. Generally, each type of animal plays a different role in livelihood, such as some animals, like buffaloes and cows, are kept for milk, which is used in the home and sold, while others, like sheep and goats, are kept for meat and wool production, and still others, like horses, mules, and oxen, are kept for their ability to use as drought power. In terms of proportion of individual species to the total livestock of the district, the highest proportion of goats (30.5 Per cent), buffaloes (30 per cent) followed by sheep (25.10 per cent) and cows (around 8 per cent) are found. It also reveals the dominancy of the species namely, goats, buffaloes and sheep in the district. Shannon-Weiner Diversity Index has been used to measure the livestock diversity **(Liao, et al., 2015).** Highest the index value means highest the livestock species diversity and lowest the index value indicates the lowest diversity. The minimum possible Shannon diversity index is 0, indicating no diversity, which means only one species is found in a habitat. Block-wise levels of diversity of livestock in the district has been calculated. In order to categorized the block into five categories in terms of livestock diversity, Jerks natural break method has been used.

It is found that there are two blocks namely Doongi and Thanamandi are recorded for the very high levels of livestock diversity with the Shannon diversity-index values ranging from 1.512 to 1.582, and the five blocks namely, Subderbani, Khawas, Darhal, Planger and Panjggrain are showing the high levels of livestock diversity with the index values ranging from 1.428 to 1.512. There are five blocks namely, Moughla, Qila-Darhal, Dhangri, Budhal nad koteranka showing the medium levels of diversity in livestock with the index values range from 1.77 to 1.28. Six blocks namely, Seri, Lamberi, Nowshera, Kalakote, Rajouri and Manjakote out of total nineteen blocks are coming under the category of low level of livestock diversity with the index values range from 0.817 to 1.277, at the same time one blocks namely Siot is recorded for very low level of livestock diversity with the index values 0.817 and below.

Fig.1

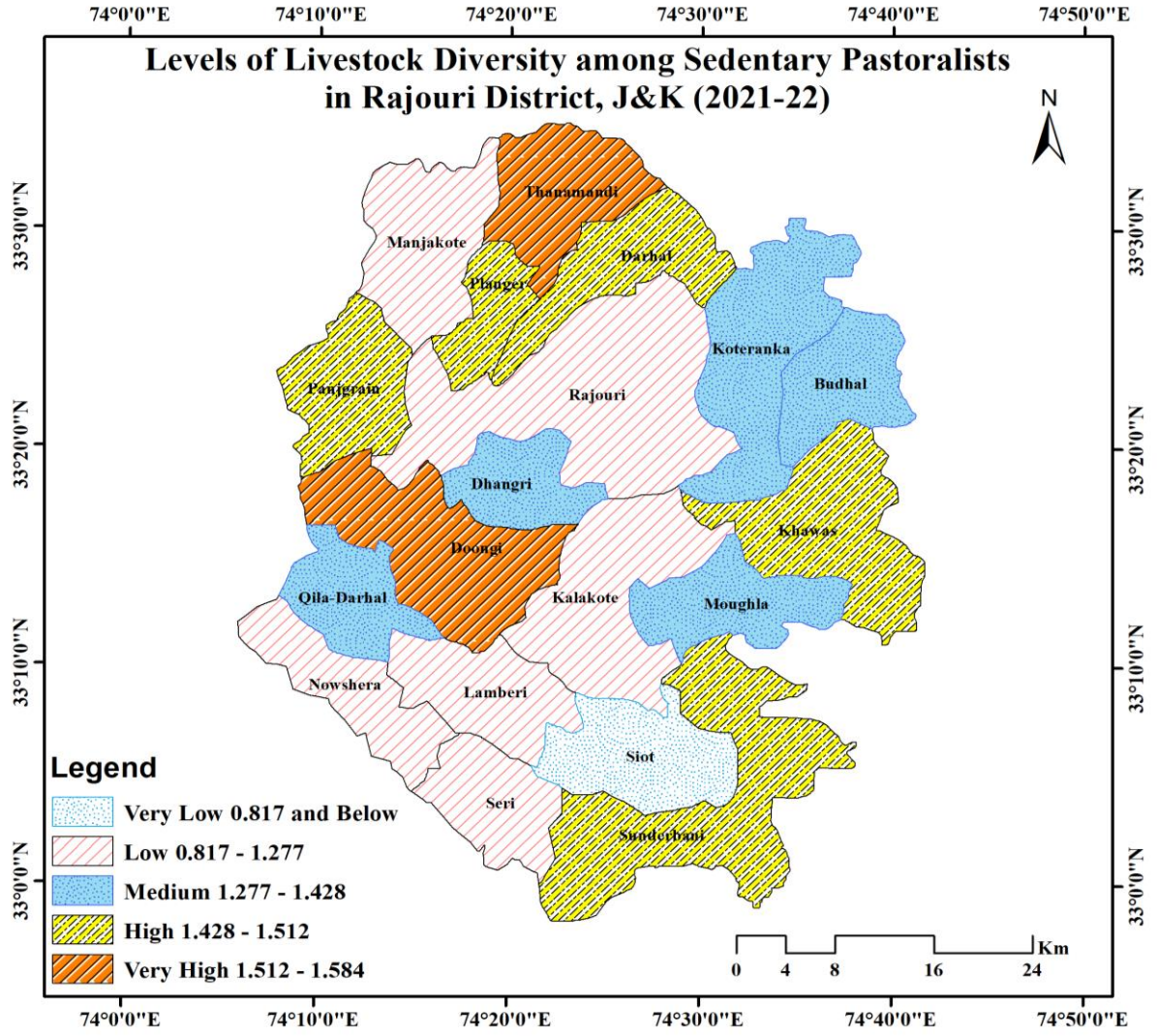


TABLE 2: LIVESTOCK DIVERSITY INDEX AMONG THE TRANSHUMANT PASTORALISTS

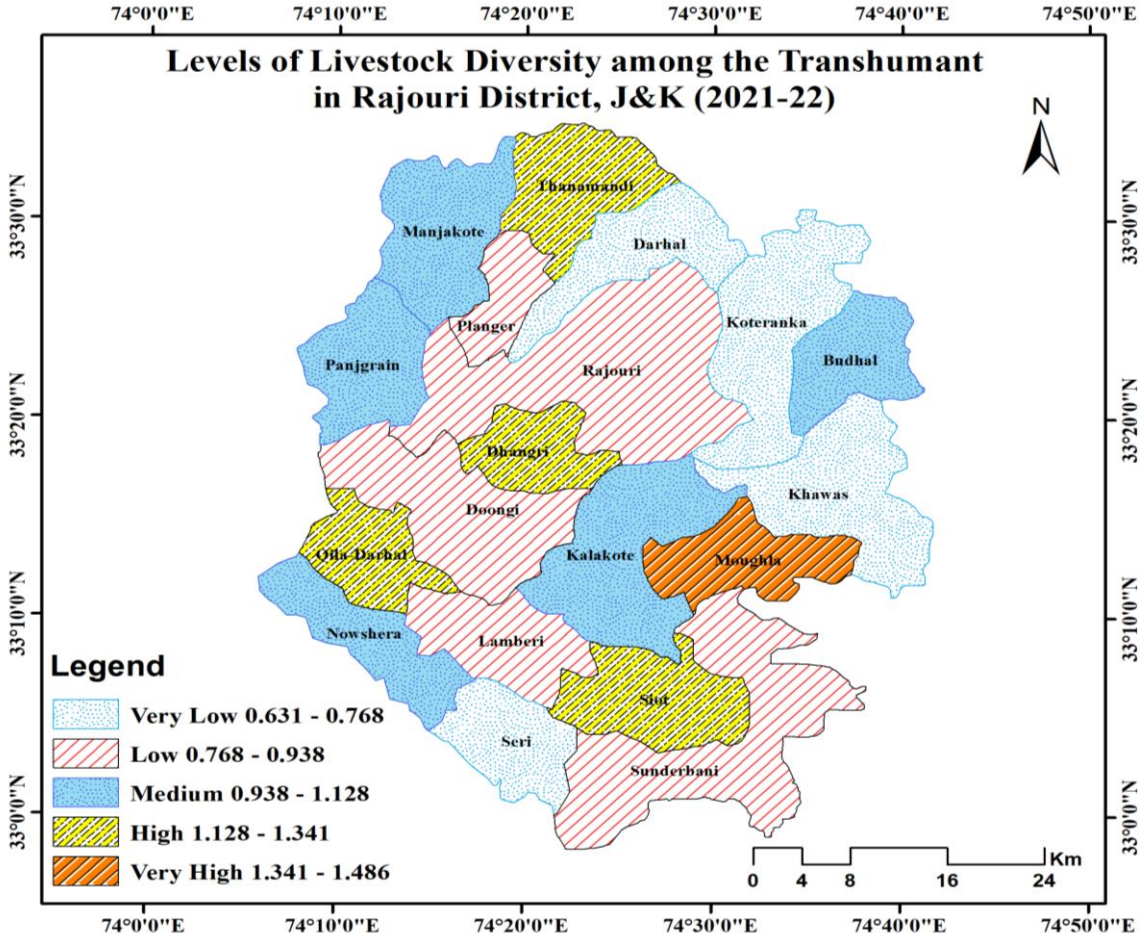
Name of the Developmental Blocks of the District	Name of the Sampled Species							Pi ln pi = (H)
	Goats	Sheep	Buffaloes	Cows	Oxen	Horses	Mules	
	Proportion (pi)							
	pi	pi	pi	pi	pi	pi	pi	
Budhal	0.194	0.693	0.079	0.004	0	0.017	0.013	0.92
Koteranka	0.345	0.543	0.066	0.003	0.182	0.035	0.002	1.335
Kalakote	0.641	0.331	0	0	0	0.017	0.01	0.768
Dhangri	0.637	0.303	0.027	0.01	0	0.019	0.004	0.892
Siot	0.676	0.278	0.018	0.006	0.091	0.014	0.006	1.034
Khawas	0.289	0.588	0.063	0.006	0.592	0.023	0.017	1.341
Sunderbani	0.716	0.246	0.001	0.007	0	0.026	0.003	0.741
Lamberi	0.682	0.271	0.012	0.006	0.075	0.021	0.006	1.007
Darhal	0.224	0.684	0.061	0.005	0.267	0.013	0.009	1.244
Moughla	0.431	0.523	0.013	0.009	0	0.014	0.009	0.908
Doongi	0.669	0.239	0.025	0.01	0.379	0.023	0.023	1.294
Palanger	0.243	0.698	0.032	0.01	0.105	0.011	0.004	1.065
Nowshera	0.819	0.132	0.008	0.005	0	0.028	0.008	0.631

Qila-Darhal	0.612	0.336	0.013	0.013	0.111	0.015	0.008	1.128
Seri	0.72	0.256	0.009	0.007	0	0.004	0.003	0.706
Manjakote	0.395	0.556	0.024	0.002	0	0.014	0.01	0.907
Rajouri	0.285	0.637	0.037	0.003	0.8	0.017	0.007	1.066
Panjgrain	0.191	0.701	0.032	0.013	0	0.051	0.013	0.938
Thanamandi	0.268	0.523	0.145	0.025	0.611	0.017	0.011	1.486
District's Total	0.528	0.404	0.031	0.008	0.003	0.019	0.008	0.979

Source: Field Survey, 2021-22

It is found that there is only blocks namely, Moughla is recorded for the very high levels of livestock diversity with the Shannon diversity-index values of 1.486, and the four blocks namely, Siot, Qila-Darhal, Dhangri and Thanamandi are showing the high levels of livestock diversity with the index values ranging from 1.128 to 1.341. There are five blocks namely, Nowshera, Kalakote, Budhal, panjgrain and Manjakote showing the medium levels of diversity in livestock with the index values range from 0.938 to 1.128. Out of the total nineteen blocks five blocks namely, Sunderbani, Lamberi, Doondi, Rajouri and Planger are coming under the category of low level of livestock diversity with the index values range from 0.768 to 0.938, while five blocks namely, Seri, Khawas, Koteranka and Darhal are recorded for very low level of livestock diversity with the index values range from 0.631 to 0.786.

Fig.2



There is significant variation found in the combination of livestock species among the sedentary/Semi-migrants and transhumance pastoralists. The study revealed that the sedentary/semi-migrants' pastoralists having the highest proportion of goats (30.5 per cent) and buffaloes (30 per cent) followed by the sheep (25 per cent), cow (7.9 per cent) and oxen (4.6 per cent) population. The composition of transhumant pastoralists' livestock unit is somewhat different from that of the sedentary. The proportion of livestock species found among the transhumant pastoralists are goats (52.8 per cent) and sheep (40.4 per cent) followed by the buffaloes (3.10 per cent) and horse (1.87 per cent). The proportion of cows and oxen population is found less in the transhumant pastoralist's livestock units. In contrast, the proportion of

horses and mules is fond least in the sedentary pastoralist's livestock units. This variation is due to the fact that the transhumance prefers to possessed horses and mules with their main livestock species to transport their luggage from one location to others at the time of their seasonal migrations, but on the other hand sedentary pastoralists prefers to possessed oxen for ploughing and threshing purposes. The dominance of sheep and goats is found among the transhumant at the same time among the sedentary pastoralists goats and buffaloes are the dominant species. The study revealed that sedentary pastoralists' livestock diversity is more than 10 per cent than that of the transhumant livestock unit. The poverty status, APL (Above the Poverty Line) is positively correlated with sedentary livestock diversity and negatively correlated with transhumant livestock diversification, because the sedentary pastoralists diversifying their livestock on the basis of getting more benefits for the animals but in the case of transhumant, they face some sort of compilation/pressure to diversify their animals for different purposes like drought power etc but not they are getting financial benefits from them. For instance, transhumant keeps horses and mules for transporting their luggage from one place to another, etc.

Keeping a variety of livestock enables pastoral households to maximise pasture utilisation while minimising the negative effects of environmental fluctuations. The additional livestock pressure has substantially negative effects on pastures' quality and quantity of forage. According to the findings, pastoralist households have a wider variety of livestock species than the non-pastoralist households. For better utilisation of both herbaceous and woody plant pastures, a common practise among pastoralists is to mix livestock species (**Lio, et al., 2015**). Different types of livestock required different types of forage; thus, diversifying the livestock units enables the fuller utilization of different grasses, herbs, shrubs and plant species. At the same time, it lesser the pressure on a single forage species and balance the ecosystem.

Conclusion

This study revealed that there is spatial variation in the diversity of livestock species among transhumant and sedentary pastoralists, as well as within pastoralists' livestock species diversity vary from one block to the next. The study revealed that sedentary pastoralists in the study area had greater livestock diversity than transhumant pastoralists. Earlier study suggests that diversification hinges on monetary policy, infrastructure development, urbanisation, and technological progress. As a result, rainfed regions have been able to replace low-quality coarse cereals with high-value crops, which has led to an increase in exports and new jobs **(Pingali & Rosegrant 1995; Joshi, et al., 2004).** The present study discovered that sedentary pastoralists' livestock diversity is more than 10 per cent than that of the transhumant livestock unit. Special attention should be paid to encourage the tribal pastoralists for diversifying their livestock. Livestock diversity minimize the risk of loss of livestock by various extreme events and also maximize the benefits from their livestock.

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