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Bakarwal Pastoralists Livelihood Resilience to Hot Weather

Abstract

This paper studies the livelihood resilience of Bakarwal pastoralists of Western Himalaya, facing hot weather stress during the months of April and May and acute magnitude hot weather in the month of June due to a disturbance in migration schedule. The present study focuses on (1) Hot weather faced by the pastoralist community in number of days (2) capacity posses by the pastoralists (3) strategies employed by the pastoralists (4) organizational support received by the pastoralists and (5) community sensitivity to hot weather on the basis of mortality and affected rate. Findings of research demonstrate that changing weather trend, and change in seasonal migration schedule during a stressful period makes the stress acute. Community possesses a number of well adaptive capacities, strategies, traditional knowledge and social capital to adapt during a stressful period. Finding shows that hot weather condition does not provide much harm to the community; the community shows higher resilience to this stressor.

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Keywords: Resilience, Livelihood, Pastoralist, Capacities, Strategies, Hot Weather.

Introduction

Bakarwal, is the pastoral nomadic community is found in Jammu and Kashmir State of India (Casmier and Rao 1985; Dewan 1999), and in Swat and Kunhar valleys of Northern Pakistan (Ehlers and Kreutzmann 2000). Bakarwal in Jammu and Kashmir has got the status of 'Schedule Tribe (ST)' under the Constitution Amendment Act 1991, No.36 of 1991 (Government of India 1991). Pastoral nomadic Bakarwals spend their winter in the Jammu Shiwaliks and summer in the alpine pastures up to Drass of Kargil district (Casmier and Rao 1985).

Reports on climate show that it has been constantly changing due to natural and anthropogenic factors; these changes mostly affect marginal societies such as pastoral nomads that depend upon traditional economic activities with simple technology (IPCC 2014). Climate changes have also been observed in the western Himalaya (Bhutiyani et al, 2010) which disturbed the seasons in the western Himalaya (Shekhar et al. 2010, Bhutiyani et al, 2010). Disturbance in the season affected the Bakarwal pastoralist migration schedule and force them to spend more days in hot weather environment.

Hot weather environment is detrimental to livestock productivity and mortality (Morrison 1983). Each animal's species has a thermal comfort zone, temperature increases above it can cause heat stress which results in changes in physiological functions (reproduction and respiration system), increase the quantity of water intake and reduce fodder intake (Lacetera et al. 2003). The imbalance between the amount of heat energy produced by animal and the prevailing environment is responsible for this condition. Prevailing environmental factors which increase the magnitude of heat stress are the duration of sunlight, clear sky, seasons and air temperature (Pierre, Cobanoy and Schnitkey 2003).

Resilience which is defined as the capacity of a system to deal with change (Stockholm Resilience Centre 2015).Resilience Alliance (2018) defines it as "the ability of a system to absorb disturbance, to be changed and then to re-organise and still have the same identity". IPCC considers resilience as the ability of a system to withstand with climatic stresses without changing its structure and function (IPCC 2007). Adger (2000, 347) defined social resilience "as the ability of groups or communities to cope with external stress and disturbances as a result of social, political and environmental change"

The present study defines Livelihood resilience as the capacities (in terms of characteristics, strategies and tolerance of livelihoods) to deal with Hot weather, and continue to develop while maintaining essential properties and functions. Livelihood resilience includes (I) buffer capacity/adaptive capacity, (II) coping, adaptive and transformative strategies and (III) Self-organization and organizational support.

Methodology

This study is based on DFID's framework on resilience livelihood (Department for International Development 2010). For this study a cross-sectional survey was conducted in the pastoralists habitat using purposive sampling, 239 families were selected, 160 families from Banihal pass route and 79 from Pir Panjal pass route. All the economic classes also included in the survey according to their proportion in the population that was 68 marginal pastoralists, 80 poor pastoralists, 60 middle-class pastoralists and 31 rich pastoralists.

The help of veterinary experts from sheep husbandry department Jammu and the help of experienced pastoralists have been taken to develop the Bakarwali translated version of scientific literature on the effect of hot weather on livestock and human being. Thus the scientific literature was translated into Bakarwali dialect which helps to draw the responses from the pastoralists. Similarly hot weather events magnitudes through Bakarwal pastoralist climatic terminologies have been drawn.

Socio-Economic and Demographic Characteristics of the Study Population

Characteristics	N=1584 (%)
Age Group (years)	
0-14	467 (29.48)
14-59	998(63.01)
60+	119(7.51)
Gender	
Male	762 (48.11)
Female	822 (51.89)
Sex Ratio	
0-14	937.76
15-59	1024.34
60 & above	1087.72
Total Sex Ratio	1078.74
Size	
Kafila size	2.45
Family size	6.63
Educational Level	
Up to Primary education	139 (66.19)
Up to Middle education	47 (22.38)
Up to High school	16 (7.62)
Up to Higher Secondary	8 (3.81)
Total Literate	210
Residence	
Eastern Habitat using Pir panjal pass	1056 (66.67)
Western Habitat using Banihal pass	528 (33.33)
Livestock Asset by species	
Total livestock	20198
Average household stock	84.51
Goat	8740
Sheep	10878
Horse	580

Hot Weather Faced by The Community

Bakarwal divided the hot weather into three categories. The high magnitude hot weather (HMHW) condition called as "Mauch garmi" in Bakakarwali language, in this the temperature is above 30 degree Celsius. The High magnitude hot weather (HMHW) prevails from the beginning of May onwards and in the upper western habitat it begins from 20 may, in the transit camps this condition prevalent in the last months of May, this environmental condition absented in the summer camps. In scientific literature, this condition is similar to Heatwave, which is a continuous spell of abnormally hot weather. The medium magnitude hot weather (MMHW) condition in the local language is called as *'Gayrmi".* In this condition temperature is 25 to 30 degree Celsius. This condition begins from mid-April to last week of April (15 days) in Eastern habitat and in the upper western habitat, it begins from May, in the transit camps it begins from the second week of May to last week of May (30days). The low magnitude hot weather (LMHW) in the pastoralists' language is called as *Garmiyan*, it begins from 20th March to mid-April. In the upper western habitat area, it begins from April 15 to 1 May. The Low magnitude in the transit camps begin from mid-April to the second week of May (30 days) for western habitat it begin from 1 May to 20 may.

Hot Weather Events Faced by the Pastoralists

Stressor Magnitude	Habitat	Duration of Events (in Days)	Exposed family (in % age)
High Magnitude (HMHW)	Winter	0.70 (SD ± 2.30) [6.22]	11.30(27)
	Transit	0.42 (SD ± 1.69) [5.61]	7.53(18)
	Summer	0	0
Medium Magnitude (MMHW)	Winter	3.56 (SD ± 4.70), [6.45]	55.23 (132)
	Transit	0.57 (SD ± 1.63), [3.68]	15.48 (37)
	Summer	0	0
Low Magnitude (LMHW)	Winter	15.91 (SD ± 6.52)),[15.91]	100(239)
	Transit	2.28 (SD ± 2.74),[4.33]	52.72 (126)
	Summer	0	0

Source: Field Survey 2017-18

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Capacity Posses by the Pastoralist

Capacities and strategies can reduce hot weather effect (Lu, C.D. 1989). Capacity is considered as the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals" (UNISDR 2018).

Capacities Availability and Utilization by the Pastoralists to Deal with Hot Weather

Capacities	Winter camps		Transit camps		Summer	
	Ownership	Utilization	Ownership	Utilization	Ownership	Utilization
C1	10.9	10.5	0	0	4.6	0
C2	0	0	0	0	0	0
C3	13.0	14.2	0	0	15.5	0
C4	6.7	8.4	0	0	1.3	0
C5	35.6	46.9	0	0	15.1	0
C6	25.5	36.0	0	0	7.9	0
C7	75.3	78.7	78.7	71.1	78.2	0
C8	20.9	62.3	0	38.9	19.7	0
C9	10.5	10.5	0	0	0	0

Source: Field Survey, 2017-18

Capacities Code

C1- Pucca shelter for human being, C2- Pucca shelter for livestock, C3- Semi Pucca for human being, C4- Semi Pucca for livestock, C5- Traditional type Shelter for human being, C6- Traditional Shelter for livestock, C7- Tent either plastic or clothes one, C8- Tree shadow, dense tree canopy or shade prepared with tree twigs and of leaves, C9- Electric gadgets used to escape from heat such as Fan, cooler or Air conditioner.

The modern animal care recommends the shelter for the livestock, the shelter provides the protection from heat; Most of the Bakarwal families did not possess any permanent structure shelter. Only 10.5 per cent utilized pucca houses in winter camps, no pastoralist utilized pucca shelter for livestock care. The ownership rights over semi pucca house was 13 per cent by the pastoralist families in the winter camps and the utilization percentage was 14.2 per cent, it means 1.2 per cent families were those who did not utilize this capacity. Semi pucca shelter for livestock protect the livestock from direct sun rays, it was observed that shelter reduced the exposure of direct sun rays and heat. In the present study, it was found that 8.4 per cent pastoralists utilized semi-pucca shelter for livestock and only 6.7 have an ownership right over it. Traditional shelter ownership in the winter camps was 35.6 per cent families with utilization percentage of 46.9 per cent of families. 30 per cent of pastoralist families still used tree shadow to escape their livestock from the heat stress.

Combination of Capacities utilized by the Pastoralists to deal with Hot Weather

Number of Capacities'	Utilization percentage In winter camps	Utilization percentage In Transit camps	Utilization percentage In summer camps
0	5.0 (12)	24.3 (58)	0
I	13.4 (32)	37.7 (90)	0
II	34.7 (83)	36.8 (88)	0
III	16.3 (39)	1.3 (3)	0
IV	19.2 (46)	0	0
V	9.2 (22)	0	0
VI	2.1 (5)	0	0

Source: Field Survey, 2017-18

In the winter camps, average family utilized a combination of 2.67 capacities (SD ± 1.40), it was found that maximum duration of hot weather was faced by the winter habitat. It was surprising to see that 5 per cent families utilized no capacity, 13.4 per cent families utilized single capacity, while 34.7 per cent of pastoralist families utilized two capacities. A combination of three capacities was utilized by 16.3 per cent pastoralists, whereas 19 per cent household utilized four different capacities to deal with the hot weather condition, only 2.1 per cent families were there who have utilized more than six capacities. In the transit camps, the average family utilized 1.15 capacities (SD ±.80). 24.3 per cent (58) families utilized not even a single capacity in the transit camps to deal with hot weather, whereas 37.7 per cent (90) families used single capacity, and 38.1percent (91) families utilized multiple capacities to deal with hot weather condition.

Coping Strategies

Coping strategies are the 'mechanisms that people choose as a way to live through difficult times' (International Federation of Red Cross and Red Crescent Societies-IFRC. 2012, 14). Coping strategy is a short-term response to a stressful condition; these are the remedial measures undertaken by people whose livelihood is under threat (Adam et al. 1998). It is mainly of five kinds, that are learning capacity, social capital, religious practices, traditional methods and implementation of technology.

Strategies Employed by the Pastoralists to deal with Hot Weather

Strategies	High Magnitude		Medium Magnitude		Low Magnitude	
	Human Being	Livestock	Human Being	Livestock	Human Being	Livestock
S1	76.6	80.8	40.2	43.9	18.4	18.4
S2	56.9	53.1	36.4	35.6	20.5	24.3
S3	58.6	60.3	33.1	40.6	20.5	25.1
S4	52.3	65.3	47.3	50.2	31.8	30.5
S5	25.1	20.1	14.2	14.6	6.3	8.8

S1-Learning Capacity, S2 -Social Capital & knowledge sharing, S3- Magic and Religious practices during, S4- Traditional methods & knowledge, S5- Employ modern methods & innovations

Learning capacity incorporates the previous experience into current action (Speranza et al., 2014) also includes knowledge of threats and opportunities, shared the societal vision, commitment to learning, knowledge identification capability (Argyris and Schön 1997). The learning strategies utilized by the Bakarwal pastoralists to deal with hot weather are taking shelter near tree shadow, move earlier, and send the old age family member and children by vehicles. Avoid fixing tent in the direct sun rays areas, shearing the sheep and goat to avoid heat stress, avoidance of some particular kinds of fodder which provides harm, modify the spatial and temporal pattern of seasonal migration according to stress. In the present study it was found that 76.6 per cent pastoralist families employed learning strategies to deal with HMHW, 40.2 per cent pastoralists employed learning strategies to deal with MMHW and only 18.4 per cent pastoralists employed learning strategies to deal LMHW. It was seen that the learning capacity for the feeble stressor was less in number. The usage of learning capacity by the pastoralists against the high magnitude events was higher in number, further, it reduces against medium magnitude events and very few pastoralists utilized their previous experience against low magnitude events. It is also observed that pastoralist who used learning capacity was more resilient to this stressful event in comparison to pastoralist who did not use it.

Social capital in the resilience framework refers to helping other during the stressful events, participation in the social network to increase assets, labour support form group member, use of group equipment, tools and infrastructure (Speranza., et al., 2014). It is helpful in adaptation to a stressful condition and leads towards resiliency (Adger 2010). It was very rare that the pastoralists donate or beg direct help from each other to deal with this stressful event. It was taken in term of suggestions. It was observed that pastoralist shared the experiences with each other and suggested remedies, sometimes it works and sometimes it does not, thus diffusion of ideas, knowledge sharing is common against this stressor. In the present study 56.9 percent sampled families employed social capital to protect the human being and 53.1% used it to protect the livestock from HMHW, 36.4 percent families used this kind of strategies to protect human being from MMHW and 35.6 percent families used similar strategies to protect livestock from MMHW, 20.5 percent of sampled families used this strategy to protect human being from LMHW whereas, 24.3 percent families used similar strategies to protect its livestock from LMHW.

From the table, it was observed that the strategies used against HMHW and MMHW to protect the human being were higher in a comparison to the livestock. In case of LMHW percentage against livestock was more than a human being. The observed reason was that pastoralist were more conscious towards their livestock health, even sacrificed own health, thus, just from the beginning of the problem the pastoralist utilized the strategies for livestock care and if these skills fail, the pastoralists reduce the implementation of a particular strategy against the HMHW and MMHW that's why the figure against utilization rate for human being was lower but higher for livestock against LMHW.

Religion and magic also raise the livelihood resilience; it provides psychological strength to deal with the shocking condition (Pulla 2013). The magic and religious practice was a common strategy utilized by the pastoralists to deal with any kind of stressful condition. The common practices were Kari, Phanda, Tabeez, went to Fakir, Peer, Duala, Masjid and on peer Manjar Etc. In the sampled families, it was seen that nearly 58.6 per cent families used magic and religious practices for the welfare of human being and 60.3 per cent families used it to protect livestock from HMHW. The percentage of household decreases with a decrease in the magnitude of the stressful condition in case of MMHW, 33.1 per cent families used this strategy to save its human labour from the grip of stressor while 40.6 per cent pastoralist families practised this strategy to save its livestock from MMHW. Against LMHW, 20.5 per cent of pastoralist families practised similar strategy to protect the human beings whereas, 25.1 per cent of pastoralist families used it to protect its livestock from the ill effects of this stressful condition.

Traditional method includes the use of traditional knowledge and ethnobotanical knowledge for the treatment of heat stress. The study observed that pastoralists used a number of tradition tactics; pastoralists drink mustard oil to the horse to recover from the heat stress, feed selective and particular kind of fodder to the livestock according to the magnitude of the stress. Gandh Soi *(Lamiaceae Nepeta cateria)*, leaves are used as a medicine to escape from bad health due to hot weather, Toonu *(Toona hexandra)* leaves are used for chronic dysentery due to hot

weather. Chobikhor *(picrorhiza kurrooa royle)* the extract of roots is feed to affected livestock to recover from the weakness which caused due to hot weather exposure. Handri (Taraxacum officinale) flower extract is mixed up with lemon to get relief from fever due to hot weather.

Among the sampled families it was found that 52.3 per cent of pastoralist families used traditional methods to cure itself from HMHW, 65.3 per cent of families used this strategy to save their livestock from HMHW. During a spell of MMHW 47.3 per cent of pastoralist families employed traditional methods to protect its human labour whereas, 50.2 per cent employed a similar strategy to protect its livestock. At the time of LMHW, 31.8 per cent sampled pastoralist families employed a similar strategy to protect its family member from hot weather exposure whereas, 30.5 per cent pastoralist families used this strategy to save its livestock.

Employ modern methods and innovation was not common among the pastoralists, it includes using modern kind of shelter, protective creams, modern medicine, modern medical treatment and modern facilities, infrastructure and modern veterinary guidelines. It was observed that pastoralist who used modern methods shows high resilience level. 25.1 per cent of pastoralist families used modern medical treatment methods for human being whereas 20.1 per cent household used this strategy to deal with HMHW. 14.6 per cent pastoralists employed a similar strategy to escape from MMHW. Very few pastoralist families employed this strategy against LMHW that were 6.3 per cent families for a human being and 8.8 per cent of families employed it for livestock.

Combination of Strategies Employed by the Pastoralists to deal with Hot Weather

Number of Strategies Employed	High Magnitude	Medium Magnitude	Low Magnitude
0	6.3 (15)	15.9 (38)	37.2 (89)
I	15.1 (36)	30.1 (72)	35.6 (85)
II	23.8 (57)	32.2 (77)	21.8 (52)
III	31.0 (74)	13.4 (32)	3.8 (9)
IV	5.4 (13)	5.4 (13)	1.3 (3)
V	18.4 (44)	2.9 (7)	0.4 (1)

Source: Field Survey, 2017-18

Combination of Strategies Employed by the Pastoralists to protect livestock from Hot Weather

Number of Strategies Employed	High Magnitude	Medium Magnitude	Low Magnitude
0	4.6 (11)	20.1 (48)	41.0 (98)
I	19.2 (46)	25.5 (61)	25.5 (61)
II	20.1 (48)	27.6 (66)	21.8 (52)
III	15.1 (36)	7.5 (18)	9.2 (22)
IV	30.1 (72)	14.6 (35)	2.1 (5)
V	10.9 (26)	4.6 (11)	0.4 (1)

Source: Field Survey, 2017-18

Organizational Supports

Government supports and other supports varies from district to district, habitat to habitat; it depends on the office of district collector to provides compensation, provision of support also depends upon the donor agencies, NGO's and government. It was also observed that the supports which they got were irregular; haphazardly and indirectly help them to cope with the hot weather condition, for example, the summer camps near to army camps got more benefit as compared to remote areas.

Kind of Supports Available and Utilized by the Pastoralists against Hot Weather

Endowment & Supports	Winter Camps		Transit Camps		Summer	
	Availability	Utilization	Availability	Utilization	Availability	Utilization
Government supports and subsidies	2.1	2.1	5.4	2.5	6.7	6.7
Safe Land allotment	9.6	9.6	0.0	0.0	14.2	14.2
Health insurance	13.0	11.3	9.6	11.3	9.6	11.3
NGO's supports	0	0	0	0	0	0
Compensation	0	0	0	0	0	0

Source: Field Survey, 2017-18

In this study, 2.1 per cent sampled families had got directly or indirectly government supports against hot weather condition in the winter camps, in the transit camps it was 2.5 per cent families and in the summer it was 6.7 per cent sampled families got support from the external agencies. The provision of safe land against hot weather was not common, 9.6 per cent of pastoralist families reported that they have allotted that kind of land which is free from hot weather exposure and this percentage was higher in the summer camps. Insurance also plays an important role to increase the resilience level it was found that 11.3 per cent of sampled families reported that their livestock is insured by the insurance agency.

Combination of Supports Utilized by the pastoralists to protect from Hot Weather

Number of supports	High Magnitude	Medium Magnitude	Low Magnitude
0	82.8 (198)	87.4 (209)	79.5 (190)
I	11.7 (28)	11.3 (27)	9.2 (22)
II	5.0 (12)	1.3 (3)	10.9 (26)
III	0	0	0.4 (1)

Source: Field Survey, 2017-18

The support available to the pastoralists from external agencies against hot weather condition was very less and very few pastoralists took the benefit of it. In the present study, 82.8 per cent (192) pastoralist families got no support against HMHW, 11.7 (28) per cent pastoralist families got single support against HMHW and 5 per cent (12) pastoralist families got two kinds of support from external agencies.

Against MMHW condition only 12.6 per cent (30) pastoralist families got support, whereas against LMHW 9.2 (22) per cent pastoralist got single support and 10.9 (26) pastoralists got two kinds of supports.

Sensitivity

Sensitivity is the degree to which a system will be affected by or will respond to a given shock or stress (Department for International Development 2010). In the present study pastoralists' livelihood sensitivity at the prevailing hot weather environment has been learnt through affected rate per 1000 persons and mortality rate per thousand persons similarly affected rate and mortality rate for livestock asset per thousand livestock.

Pastoralists Sensitivity to Hot Weather Environment

Stressor Magnitude	Habitat	Affected rate per 1000 persons	Mortality per 1000 persons	Case Fatality Rate (CFR)
High Magnitude	Winter	17.68	0	0
	Transit	15.15	0	0
	Summer	0	0	0
Medium Magnitude	Winter	13.89	0	0
	Transit	8.84	0	0
	Summer	0	0	0
Low Magnitude	Winter	5.68	0	0
	Transit	1.89	0	0
	Summer	0	0	0

Source: Field Survey, 2017-18

The table reveals this kind of stressful condition is not deadly, it only affects pastoralists comfort. Winter habitat recorded high affected rate that was 37.25 persons per thousand followed by transit camps 23.99 pastoralists per thousand pastoralists, while this kind of stressful condition was absented in summer camps of the pastoralists. In the present study, the community faced just 1.12 days duration of HMHW event which has impaired the health of 33 pastoralists per thousand pastoralists. Thus HMHW is highly morbid for the pastoralist. The community faced 4.13 days of MMHW condition and the affected rate was 21 persons whereas LMHW affected rate was 8 persons per thousand populations and no human morality reported in this study due to hot weather.

Livestock Sensitivity to Hot Weather Stress

Stressor Magnitude	Habitat	Affected Rate (per 1000 Livestock)	Mortality (per 1000 Livestock)	Case Fatality Rate (CFR)
High Magnitude	Winter	6.49 (131)	0.74 (15)	11.45
	Transit	4.51 (91)	0.30(6)	6.59
	Summer	0	0	0
Medium Magnitude	Winter	6.63 (134)	0.64(13)	9.70
	Transit	1.63 (33)	0.05(1)	3.03
	Summer	0	0	0
Low Magnitude	Winter	1.58 (32)	0	0
	Transit	0.45 (9)	0	0
	Summer	0	0	0
Total		21.29 (430)	1.73(35)	8.14

Source: Field Survey, 2017-18

The mortality of livestock is an important concern for pastoralist livelihood. The table reveals that 1.73 livestock died per thousand livestock due to hot weather and the affected rate was 21.29 livestock per thousand livestock with a CFR of 8.14. The HMHW of 1.12 days duration affected 11 livestock and killed 1.04 livestock per thousand livestock. The livestock affected due to MMHW was 8.26 per thousand livestock and the mortality rate was 0.69 per thousand livestock. The LMHW was not fatalist but impaired the health of livestock; the affected rate per thousand livestock was 2.03 livestock. It was seen that winter camps were more stressful, the livestock affected rate was 14.7 livestock per thousand with a mortality rate of 1.38 followed by transit camps with the affected rate of 6.59 and mortality rate of 0.35 livestock, thus winter habitat is more stressful for pastoralists.

Conclusion

The result shows that community moves towards a resilient path and bounce back towards normalcy at the given environment. The inferential statistics results show that the condition becomes deadly and thus may collapse the livelihood if the HMHW facing duration has increased, moreover the capacity and strategies to deal with MMHW and

LMHW was capable to counter the bad effect of the stressful condition. It was known that the fatal effect of hot weather on the human being was zero; the stress only affected the health impairment of pastoralists. The values of livestock converted to the Indian rupee. The estimated annual monetary loss of rupees 750 per family per year has incurred according to 2017-18 prices. In the specific livestock species analysis, it was found that the mortality rate of sheep in this stressful environment was more than goat species, whereas no mortality of horses was reported in the survey. It was also observed that families those left the summer late are adapted to hot weather and shows less affected rate in the medium and low magnitude stress.

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