Assessing the Effects of Flood on Crop and Livestock Production in Bagalkot District of Karnataka, India

ABSTRACT

Aims: India is the second most flood-affected country, trailing behind Bangladesh. Over the past two decades, Karnataka has been subjected to severe flooding. Keeping the above in view, a research initiative to analyze the effect of floods on crop and livestock production was undertaken.

Study design: Multi stage purposive sampling technique was adopted for the study.

Place and Duration of Study: Bagalkot district of Northern Karnataka was purposively selected for the study.

Methodology: The study is based on primary data collected from 90 respondents belonging to Ghataprabha and Krishna river basins in Mudhol (45) and Jamakhandi (45) taluks.

Results: Analysis of cropping patterns reveals sugarcane as the dominant crop with maize also significant. Floods in 2019 caused substantial crop damage, particularly affecting sugarcane and maize, resulting in significant income losses for farmers. The results indicated that the, during 2019, 78.03 and 21.97 per cent of sugarcane and maize areas were affected by floods with apercentage income reduction of 65.84 and 62.87 percent, respectively. The severity of flood was quite less during 2020 where 76.72 and 23.27 percent of sugarcane and maize areas were affected by floods with 29.47 and 33.24 percent, reduction in income respectively.

Conclusion: Livestock losses were also considerable, with farmers facing economic burdens due to animal deaths and injuries. Soil erosion, predominantly splash and sheet erosion, was prevalent during both years, affecting agricultural productivity. Compensation for losses remained inadequate, highlighting challenges in addressing flood-related damages in the region.

Keywords: Flood impact, crop and livestock damage, soil erosion, income loss, and climate change.

1. INTRODUCTION

India is a land of agriculture, covering 60.43% of the land (World Bank, 2018) under agriculture and it contributes around 20.19% to the Gross Domestic Product of the Indian economy (Economic Survey, 2020-21). Agriculture is acclimatized to all climatic conditions which vary from season to season and place to place. Climate change nowa challenging issue in the world and it pose athreat to many sectors. The trends and patterns of climate change vary throughout time and space, are extremely complicated, and involve a variety of factors. The predominant temperature during the crop growth cycle, and more specifically during the rice flowering stage, is a major factor in determining the rice yield. In addition to temperature, excessive rainfall during the crop-growing period also has an impact on rice yield. (Chahal *et al*., 2007).

Climate change and its impact on agriculture have raised significant concerns regarding the future food supply to sustain the growing global population. The effects of climate change include heightened occurrences of droughts, floods, and erratic precipitation patterns (Lesk *et al*., 2016), leading to approximately a 30% reduction in crop yields across diverse geographical regions (Parvin, 2016; Verschuur*et al*., 2021). Over the period from 2008 to 2018, these climate-related events, including droughts, floods, and other natural disasters, severely affected the agriculture sectors of least-developed countries (LDCs) and low- and middle-income countries (LMICs), resulting in losses exceeding USD 108 billion. The exposed population faces significant challenges in safeguarding themselves against natural hazards and must endure the repercussions of extensive environmental alterations. These alterations encompass land degradation, biodiversity depletion, and climate shifts, all of which detrimentally impact the well-being of the most susceptible communities (Devi *et al*., 2021).

All living species in nature require water as a basic requirement. Water is an economic good and a productive resource when it is in sufficient amount and quality; when it is in excess, it causes calamity and economic loss. Flooding is a natural disaster that has wreaked havoc on cultivable lands. Any disruption to the cultivable lands could have a far-reaching impact on the farming community (Ara, 2019,). Bagalkot is a prospective farming district due to its abundant water supply (Ghataprabha, Malaprabhaand Krishna Rivers). Villages on the riverbanks have been washed away in recent years owing to excessive rains followed by flooding. Farmers in this region face a slew of issues, including medical emergencies, crop losses, loss of assetsand livestock contribute to a drop in employment and farm income (Beevi, 2014; Femi, 2020).

Duringthe rainy season, the Krishna, Ghataprabha, and Malaprabha rivers, as well as their tributaries, may cause flooding in Bagalkot district. Things worsen as the flood causes destruction to the impacted area's crops and serves as a breeding ground for illnesses. The devastating floods and landslides affecting standing have caused loss of lives and enormous damage to crops and critical infrastructure. In August 2019, 91 human lives were lost due to the floods and landslides. Many villages have been flattened due to landslides/mudslides. While the people of the affected districts have gone through immense hardship, the loss of shelter has been a devastating experience. Around 2.47 lakh

houses have been damaged, out of which about 1.79 lakh houses are severely/fully damaged. About 9.70 lakh hectares of agriculture, horticulture, and plantation crops have been damaged and alarge swathe of the fields are heavily silted due to change in river course and inundation. Landslides and mudslides in multiple locations have completely destroyed around 13,663.51 ha of agriculture and horticulture areas. The crop loss due to flood and landslides was Rs.15,230.00 crores of agriculture and horticulture sector. Critical infrastructures, such as roads, bridges/culverts, electrical infrastructure, schools, hospitals, and anganwadisetc, have been ravaged due to floods.

Floods will have a negative impact on our economy, which is exacerbated by India's enormous poverty bythe planning commission. Poor farmer's circumstances are deteriorating and it becoming increasingly hard time for them to meet the fundamental necessities (Fakhruddin, 2015). Flood dangers, specifically, have effects on numerous anthropogenic activities, including two primary sectors, agriculture and society's socio-economic conditions (Bhaduri, 2013; Beevi, 2014). Duringthe rainy season, the Krishna, Ghataprabha, and Malaprabha rivers, as well as their tributaries, may cause flooding in Bagalkot district. Things worsen as the flood causes destruction to the impacted area's crops and serves as a breeding ground for illnesses. The devastating floods and landslides affecting standing have caused loss of lives and enormous damage to crops and critical infrastructure. In August 2019, 91 human lives were lost due to the floods and landslides. Many villages have been flattened due to landslides/mudslides. While the people of the affected districts have gone through immense hardship, the loss of shelter has been a devastating experience. Around 2.47 lakh houses have been damaged, out of which about 1.79 lakh houses are severely/fully damaged. About 9.70 lakh hectares of agriculture, horticulture, and plantation crops have been damaged anda large swathe of the fields are heavily silted due to change in river course and inundation. Landslides and mudslides in multiple locations have completely destroyed around 13,663.51 ha of agriculture and horticulture areas. The crop loss due to flood and landslides was Rs.15,230.00 crores of agriculture and horticulture sector. Critical infrastructures, such as roads, bridges/culverts, electrical infrastructure, schools, hospitals, and anganwadis, etc, have been ravaged due to floods (https://bagalkot.nic.in/en/bagalkot-flood/).

The major effects of theflood are every year, millions of individuals become homeless, requiring multiple days of shelter and being forced to sleep under the stars (Lavanya, 2016). Millions of homes and villages were damaged, with many of them collapsing. Hundreds of people drowned in the floodwaters and a similar number died as a result of a shortage of food or illnesses. Flooding also has submerged millions of hectares of agricultural land, rendering it unfit for further cultivation(Santhi,Veerakumaran, 2019; Devi *et al*., 2021). Several main rivers and their tributaries in the country eroded millions of tonnes of fertile topsoil, which was eventually deposited in the sea. Thousands of hectares of land have been transformed into wasteland, barren land, resulting in saline and alkalinity concerns, as well as water logging. The production of various agricultural crops, notably cash crops, has decreased significantly or has lost quality and quantity.In light of the foregoing facts and information, a study of the effects of floods

on crop and livestock production inthe Bagalkot district of Karnataka is required, with this background the current study was undertaken to analyze the nature and extent of crop and livestock damage due to floods in Bagalkot district of Karnataka.

2. METHODOLOGY

2.1. Sampling design

Bagalkot district of northern Karnataka was purposively selected for the study asthe district is highly prone to flood given Krishna and Ghataprabha basin belongs to said district of Karnataka. Flood-affected households were randomly selected which falls under severely affected villages of Krishna and Ghataprabhabasins in the district. Further, inthe river banks of Mudhol taluka 45 affected households and another 45 affected households in Jamakhanditaluka were selected randomly. Thus, thetotal size of the sample of 90 households selected for the study.

2.2. Data collection

The necessary data were collected from the respondents by personal interview method usinga pre-tested structured schedule. The majority of the respondents did not maintain records with regard toloss incurred by them. Hence, thedata collected were based on the memory of respondents.At the time of interview, personal bias of the sample farmers was minimized by convincing them about the purpose for which the data were collected. Each one of them was interviewed separately to collect the necessary information.The primary data about the nature and extent of crop damage and livestock loss, and the extent of compensation received by farmers due to crop loss were elicited from the farmers.

The extent of compensation given to the farmers due to crop loss and also loss on other assets were elicited from theState Natural Disaster Monitoring Centre, National Disaster Management Authority, etc. The rainfall data were obtained fromthe Indian Meteorological Department to assess the extent of flood damages to crops and other assets.

2.3. Tabular presentation and descriptive statistics

The data collected were presented in tabular form to facilitate easy comparison. The number of farmers affected due to floods andthe total area covered were analyzed using tabular analysis. The data pertains tothe nature and extent of crop damage due to floods, andstages of crop loss were analyzed using simple percentages and averages. The croploss andloss of livestock were also analyzed using tabular analysis, Descriptive statistics like averages and percentages were used to compare, contrast, and interpret results. The data pertains to the nature and extent of crop damage due to floods, stages of crop loss, nature, theextent of soilerosion, and loss of livestockwere analyzed using simple percentages and averages.

2.4. Cropping intensity

It refers tothe raising of a number of crops from the same field during one agricultural year; it can be computed using the formula given below.

$$\text{Cropping Intensity} = \frac{\text{Gross cropped area}}{\text{Net cropped area}} \times 100$$

Gross Cropped Area: it represents the total area sown once and/or more than once in a particular year, i.e., the area is counted as many times as there are sowings in a year. This total area is also known as the total cropped area.

Net Sown Area: This represents the total area sown with crops and orchards.The area sowed more than once in the same year is counted only once.

3. Result and Discussion

3.1. Cropping pattern of sample respondents in the study area

The study attempted to analyze the cropping pattern followed in the study area. Maize, sugar cane, and coconut were the only cereal, commercial, and horticultural crops grown in the study area. The existence of only three crops in the study area was because of the climatic conditions, adequate availability of water sources, fertile soilon in the banks of rivers, and other agroclimatic conditionsthat prompted farmers to cultivate the sugarcane. Sugarcane dominated in the cultivated area and there was no cultivation of any pulse crop in the study area. This was mainly attributed to enough theavailability of irrigation water, easy maintenance, and no problem in the marketing of the produce. More number of sugar factories are situated in and around the study area helping the farmers for easy transportation of sugarcane to the factories. The other reason is that occurrence of floods is becoming common every year. Farmers are not in the position of growing any other crop other than sugarcane.

Table 1 represents the cropping pattern of sample respondents during 2019 and 2020. The gross cropped area and net cropped area inthe kharif season 2019 were 1786.85 and 893.75 acres, respectively. In the kharif season, sugarcane was the major crop cultivated in the area which accounts for 76.64 percent (685 acres) of the total cropped area followed by 22.60 % of maize (202 acres). Inthe rabi season maize, accounts for 61.91 percent (553 acres) of the total cropped area followed by sugar cane at 37.39 percent (334 acres). The occurrence of severe floods in Kharif 2019 (August and September) month resulted in huge loss to the sugar cane farmers Cereal crop (maize) dominated the total cropped area in the rabi season 2019.

The gross and net cropped area in Kharif season 2020 was 1780.10 and 893.10 acres, respectively. In Kharif season, sugarcane was the major crop cultivated in the study area accounting for 78.26 percent (699 acres) of thetotal cropped area followed by maize with 21.05 percent (188 acres) while in rabi season sugarcane accounts for 64.03 percent (568 acres) of the total cropped area followed by maize with 35.96 percent (319 acres).

Table 1: Cropping pattern of sample respondents during 2019 and 2020

2019						
Sl. No.	**Crop group**		**Kharif**		**Rabi/summer**	
		Crops	**Area (acres)**	**Percentage**	**Area (acres)**	**Percentage**
I.	Cereals	Maize	202.00	22.60	553.00	61.91
II.	Pulses		0.00	0.00	0.00	00.00
III.	Commercial crops	Sugarcane	685.00	76.64	334.00	37.39
IV.	Horticultural crops	Coconut	6.75	0.75	6.10	0.68
	Total	-	893.75	100.00	893.10	100.00
	Gross cropped area (acres)	-	1786.85	-	1786.85	-
	Net cropped area (acres)	-	893.75	-	893.75	-
	Cropping intensity	-	-	-	199.92	-
2020						
Sl. No.	**Crop group**		**Kharif**		**Rabi/summer**	
		Crops	**Area (acres)**	**Percentage**	**Area (acres)**	**Percentage**
I.	Cereals	Maize	188.00	21.05	319.00	35.96
II.	Pulses		0.00	0.00	0.00	0.00
III.	Commercial crops	Sugarcane	699.00	78.26	568.00	64.03
IV.	Horticultural crops	Coconut	6.10	0.68	5.80	0.01
	Total	-	893.10	100.00	887.00	100.00
	Gross cropped area	-	1780.10	-	1780.10	-
	Net cropped area	-	893.10	-	893.10	-
	Cropping-intensity	-	-	-	199.31	-

3.2. Nature and extent of crop damage due to floods during 2019 and 2020

The results pertaining tothe nature and extent of crop loss due to floods during 2019 and 2020 are presented here under (Table 2). In the year 2019, the average income realized by the sample households was Rs. 1,29,600 against the expected average income of Rs. 9,86,400 per household. The percentage deviation in the income obtained by the households was 65.84 percent in sugarcane.

During Kharif 2019, 127 acres of maize were affected (62.87 % of the total maize sown area) due to floods. The average yield obtained from maize in flood-affected areas was 27.91 quintals with a market price of Rs. 1,337 per quintal. The average income realized by the sample households was Rs. 37,315 against the expected average income of Rs. 83,808.48 per household. The percentage deviation in the income obtained by the households was 62.87 percent in maize.

During 2020, amount of total of 887 acres of cultivable land, and 268.50 acres (30.27 % cultivable land) of land were affected due to floods. The total income lost due to floods was 2,96,49,633 (29.82 %) in the study area. Again both sugarcane and maize were the crops affected due to floods in thestudy area. During Kharif 2020, in total 206 acres of sugarcane were affected (29.47 % of the cultivable area) realizing an average market price of Rs. 2850 per tonne. The average income realized by the sample household was Rs. 1,29,048 per household against the expected average income of Rs. 10,02,272.80 per household. The percentage deviation in the income obtained by the households from Sugarcane was 29.47 percent.

The Second important crop affected due to floods during Kharif 2020 was maize with 62.50 acres (21.19 % of the total cultivable area). The average yield obtained from maize was 27.76 quintals per acre with a market price of Rs. 1,767 per quintal. The average income obtained by the sample households was Rs. 49,051per household against the expected average income of Rs. 1,02,464 per household. The percentage deviation in the income obtained by the households was 33.24 percent.

Table 2: Nature and extent of crop damage due to floods during 2019 and 2020

(n=90)

2019									
Sl. No.	**Name of the crop**	**Total area under the crop (acre)**	**Area affected due to floods (acre)**	**Yield (Qtls /acre)**	**Market price received (Rs /Qtls)**	**Average income generated from crops in flood affected area (Rs.)**	**Average expected income generation in affected area (Rs.)**	**Average short fall in income in flood affected area (Rs.)**	**Percentage short fall**
1	Sugarcane	685	451 (78.03)	480.00	270	1,29,600	9,86,400	6,49,440	65.84
2	Maize	202	127 (21.97)	27.91	1,337	37,315	83,808	52,691	62.87
	Average	9.86	6.42 (100)			1,66,915	10,70,208	7,02,131	65.61
2020									
Sl. No.	**Name of the crop**	**Total area under the crop (acre)**	**Area affected due to floods (acre)**	**Yield (Qtls /acre)**	**Market price received (Rs /Qtls)**	**Average income generated from crops in flood affected area (Rs.)**	**Average expected income generation in affected area (Rs.)**	**Average short fall in income in flood affected area (Rs.)**	**Percentage short fall**
1	Sugarcane	699	206 (76.72)	452.80	285	1,29,048	10,02,272.80	2,95,376.53	29.47
2	Maize	188	62.50 (23.27)	27.76	1767	49,051	1,02,464	34,063.83	33.24
	Average	9.85	2.98 (100)			1,78,099	11,04,736.80	3,29,440.37	29.82

3.3 Stages of crop loss due to floods during 2019 and 2020

The result of crop loss at different stages of crops due to floods during 2019 and 2020 is presented in Table 3. It could be observed that during 2019, in sugarcane, the highest crop loss occurred (55.05 %) followed by more than 240 days old sugarcane crop was affected as reported by 49 farmers. 120 to 240 days old sugarcane crop as reported by 24 farmers (26.69 %). 120 days old sugarcane crop as reported by 16 farmers (17.07 % of respondents).

Similarly,in2020 (Table 3), in sugarcane, the highest crop loss occurred (51.19 %) is more than 240 days old sugarcane crops as reported by 43 farmers. Followed by 120 to 240 days old sugarcane crop as reported by 29 farmers (34.52 %). The crop loss occurred in less than 120 days old sugarcane crop reported by 12 farmers (14.28 %). The majority of the sugarcane crop loss was at the harvesting stage of the crop because floods occurred in August andthe first week of September. It is the harvesting period of the sugarcane that directly effectsthe income realized by the farmers and at the same time sugar factories started crushing the sugarcane.

In maize during 2019 (Table 3), the highest crop loss occurred between 30 to 60 days old maize plants reported by 57 farmers (63.33 %). Followed by more than 60 days old maize crop reported by 28 farmers (31.11%). The least crop loss occurred in less than 30 days old plants reported by five farmers (5.56%). The results revealed thatthe majority of the crop damage was during the middle stage of the crop i.e., between 60 to 90 days old maize plants and very a small number of farmers reported crop damage at the earlier stage of the crop.

During 2020, the highest crop loss occurred between 30 to 60 days old maize plants *i.e.,* which wasreported by 32 famers (66.66 %). Followed by more than 60 days old maize crop, which was reported by 11 farmers (22.91 %). The least crop loss occurred in thecase of less than 30 days old crop, which was reported by five farmers (10.41 %). Herea major portion of the maize crop damage was reported during the middle stage of the crop growth this is because, at the time of flood, the crop was at flowering and cob development stage.

Table 3: Crop loss due to floods during different stages of crop 2019 and 2020

2019					
Sl. No.	**Particulars**	**No. of Farmers (Sugarcane)**	**Percentage to the total**	**No. of Farmers (Maize)**	**Percentage to total**
1	Early stage	16	17.97	5	5.56
2	Middle stage	24	26.96	57	63.33
3	Maturity stage	49	55.05	28	31.11
	Total	89	100	90	100

2020					
Sl. No.	**Particulars**	**No. of Farmers (Sugarcane)**	**Percentage to the total**	**No. of Farmers (Maize)**	**Percentage to total**
1	Early stage	12	14.28	5	10.41
2	Middle stage	29	34.52	32	66.66
3	Maturity stage	43	51.19	11	22.91
	Total	84	100	48	100

3.4 Nature and extent of soil erosion due to floods during 2019 and 2020

Table 4. represents the different types of erosionthat occurred along with area affected due to erosion. During 2019, 18 acres of the area were affected by splash erosion due to flood as reported by of four farmers, and 24 acres of the area were affected by sheet erosion as reported by seven farmers. While by rill erosion, 14 acres were affected due to floods as reported by five farmers. Lastly, by gully erosion, 11 acres of land was affected by floods as reported by three farmers. The total number of farmers affected due to different kinds of erosion caused by floods was 19 farmers withthe total affected area due to floodbeing 67 acres.

During 2020, 14 acres of thearea were affected by splash erosion caused due to floods as reported by four farmers, and 19 acres of the area were affected by sheet erosion as reported by seven farmers. While, by rill erosion, 10 acres of land was affected as reported by five farmers. Lastly, by gully erosion, six acres of land were affected due to floods as reported by three farmers. The total number of farmers affected by different kinds of erosion caused by floods was 19 farmers. While the total area affected by different kinds of erosion caused by floods was 49 acres. From Table 4, it can be observed that the area affected by erosion caused by floods was higher during 2019 in comparison with 2020. This is becausethe 2019 flooding was more intensive compared tothe 2020 floods.

Table 4: Nature and extent of soil erosion due to floods during 2019 and 2020

(n=90)

		2019		2020	
Sl. No.	**Type of soil erosion**	**No. of farmers**	**Area affected due to soil erosion (acres)**	**No. of farmers**	**Area affected due to soil erosion (acres)**
1	Splash erosion	4	18	4	14
2	Sheet erosion	7	24	7	19
3	Rill erosion	5	14	5	10
4	Gully erosion	3	11	3	6
	Total	19	67	19	49

3.3. Loss of livestock due to floods during 2019 and 2020

The result in Table 5 depicts the loss incurred by the farmers due to the loss of livestock caused by floods during 2019 and 2020. During 2019, the study area was affected by severe flooding andthe large number of farming community was affected by floods not only human beings but also large numbers of animals were also affected by the floods.

The impact of floods was massive on the lives of the animals and it also affected the health of the animals. This has addedan extra burden to the farmers to pay for the health check-up of the animals. Finally, it ended up affecting the economic condition of the farmers in the study area. The results from Table 5 revealed that three farmers reported the death of three draught animals with an average loss of Rs. 50,000 from each animal while eight farmers reported severe injury to 42 draught animals resulting in an average medical expense of Rs. 571.11for draught animal. Two farmers reported the death of two milch animals during the flooding resulted in an average loss of Rs. 57,500 for each animal while 10 farmers reported injury to 35 milch animals reported in an average medical expense of Rs. 312.22 for each animal. It causedan extra burden to the farmers during their critical condition. Four farmers reported the death of four calve/heifers with an average loss of Rs. 5,000 for each calves/heifer while nine farmers reported the injuries of 18 calves with an average medical expense incurred of Rs. 268.89 from each calve/heifer. Further, six farmers reported death of 10 with an average of loss Rs. 28,000 for each sheep while 12 farmers reported the injuries to 53 sheep with an average medical expense of Rs. 600 for each sheep. Five farmers reported the death of seven goats with an average loss of Rs. 14,571 for each goat while 11 farmers reported injuries to 19 goats with an average medical expense of Rs. 117.78 for each goat. Lastly, six farmers reported the loss of

eight poultry birds with an average loss of Rs. 295 for each bird while four farmers reported the injuries of 14 birds with an average medical expense of Rs. 6.11 for each bird.

During 2019 is totalof 26 farmers reported the death of 34 animals because of the severe flooding in the study area. The average loss incurred was Rs. 1,55,366 due tothe death of animals and it impacted 26 farmers. The majority of farm families are mainly depend on the income generated from livestock for their family spending for food, shelter, and clothing. Almost 54 farmers reported injuries to 181 animals due to the floods. The average medical expenses incurred for treatment of the affected animals was Rs. 1,876.11. It was very difficult to arrange the money for the treatment at the critical time of flooding faced by the farmers in the study area.

During 2020, eight farmers reported severe injury to 17 draught animals resulting in incurring an average medical expense of Rs. 102.22 for each animal. One farmer reported the death of one milch animal resulted in an average loss of Rs. 50,000 from each milch animal while 10 farmers reported injury to 17 milch animals with an average medical expense of Rs. 323.33 for each animal. Two farmers reported the death of two calves/heifers with an average loss of Rs. 4,000 for each calves/heifer while 10 farmers reported injuries to 16 calves with an average medical expense of Rs. 103.33 for each calves/heifer. Further, four farmers reported the death of four sheep with an average of loss Rs. 24,250 for each sheep while 10 farmers reported injuries to 15 sheep with an average medical expense of Rs. 113.48 for each sheep.

Three farmers reported the death of three goats with an average loss of Rs. 16,666 for each goat while six farmers reported injuries to 13 goats with an average medical expense of Rs. 224.44 for each goat. Lastly, two farmers reported the loss of two poultry birds with an average loss of Rs. 275 for each poultry bird while four farmers reported injuries to six birds with an average medical expense of Rs. 150 for each bird.

During 2020 in total 12 farmers reported the death of 12 animals because of the severe flooding in the study area. The average loss reported was Rs. 95,191 due tothe death of animals and it impacted 12 farmers Whereas 48 farmers reported injuries to 84 animals due to the flooding. The average medical expenses incurred for thetreatment of the affected animals was Rs. 1,016.

The effect of flooding was much more severe during 2019 in comparison with 2020. The farmers lost their animals more and also,and the number of animalsthat died as injured was also more. This has resulted in huge amount of loss incurred due to flooding. This has severely affected the living conditions of the farmers. It has pushed them to the pathetic condition of no income generation from the livestock. At this difficult time, farmers need to spend on livestock for their survival again pushed them to amore difficult situation.

Table 5: Loss of livestock's due to flood during 2019 and 2020

2019							
Sl. No.	Particulars	Deaths			Injuries		
		No. of farmers reported	No. of deaths	Average loss incurred due to death (Rs./animal)	No. of farmers reported	No. of injuries reported	Avg. medical expenses (Rs./animal)
1	Draught animals	3	3	50,000	8	42	571.11
2	Milch animals	2	2	57,500	10	35	312.22
3	Calves and heifers	4	4	5,000	9	18	268.89
4	Sheep	6	10	28,000	12	53	600
5	Goat	5	7	14,571	11	19	117.78
6	Poultry	6	8	295	4	14	6.11
	Total	26	34	1,55,366	54	181	1,876.11
2020							
Sl. No.	Particulars	Deaths			Injuries		
		No. of farmers reported	No. of deaths	Average loss incurred due to death (Rs./animal)	No. of farmers reported	No. of injuries reported	Avg. medical expenses (Rs./animal)
1	Draught animals	0	0	0	8	17	102.22
2	Milch animals	1	1	50,000	10	17	323.33
3	Calves and heifers	2	2	4,000	10	16	103.33
4	Sheep	4	4	24,250	10	15	113.48
5	Goat	3	3	16,666	6	13	224.44
6	Poultry	2	2	275	4	6	150
	Total	12	12	95,191	48	84	1,016.80

3.4. Loss of trees due to floods damage during 2019 and 2020

The impact of flooding was severe during 2019 compared to 2020 which was reflected in terms of trees grown on the farm land. Table 6 indicates the lossof trees grown on the farmlands due to floods in both years. During 2019, the sample farmers numbering 10 reported loss of trees grown on the farm withan average loss of Rs.29,500. Similarly, during 2020, the farmers numbering 06 reported aloss of trees grown on the farm due to floods resulting in average loss of Rs. 21,667 per household.

Table 6: Loss of trees on farm due to floods damage during 2019 and 2020

Year	No of farmers reported	No. of trees	Value lost	Average value (Rs.)
2019	10	32	295000	29500
2020	6	15	130000	21667

3.5. Loss and Compensation received due to flood during 2019 and 2020

Table 7 presents data on the average loss versus the average compensation received for various categories of losses reported during the years 2019 and 2020, with a total sample size of 90 cases. In 2019, for crop loss, the average reported loss was Rs. 7,02,131, while the average compensation received was Rs. 64,222. For loss of livestock, the average reported loss was Rs. 8,258, but no compensation was received. Loss of trees also resulted in reported losses, with an average of Rs. 3,277, but no compensation was received. In 2020, the average reported losses decreased for all categories compared to 2019. For thecrop loss, the average reported loss was Rs. 3,29,440, and the average compensation received decreased to Rs. 29,833. Loss of livestock and trees also showed decreases in average reported losses, with Rs. 2,434 and Rs. 1,444 respectively, but no compensation was received for either category. The results revealed that the decreases in average reported losses from 2019 to 2020, the average compensation received also decreased or remained at zero for all categories, indicating potential challenges in receiving adequate compensation for losses incurred.

Table 7: Average loss vs. Average compensation received during 2019 and 2020

(n=90)

		2019			2020		
Sl. No.	**Particulars**	**Number reported**	**Average loss (Rs.)**	**Average Compensation received (Rs.)**	**Number reported**	**Average loss (Rs.)**	**Average Compensation received (Rs.)**
1	Crop loss	90	7,02,131	64,222	86	3,29,440	29,833
2	Loss of livestock	41	8,258	0	26	2,434	0
3	Loss of trees	10	3,277	0	6	1,444	0

4. CONCLUSION

The significant impact of floods on crop and livestock production in Bagalkot district, Karnataka, as evidenced by the substantial losses incurred by farmers in both 2019 and 2020. The analysis reveals that floods caused extensive damage to sugarcane and maize crops, leading to substantial economic losses for farmers, especially during the critical harvesting period. Livestock also suffered severe casualties and injuries, further exacerbating the financial lossfor farming households. Moreover, the study underscores the inadequacy of compensation mechanisms, as evidenced by the disparity between reported losses and compensation received, indicating a pressing need for policy interventions to address this issue. It is imperative to implement robust flood management strategies, including early warning systems, crop insurance schemes, and financial assistance programs, to mitigate the adverse impacts of floods on agricultural livelihoods. Additionally, measures to enhance soil conservation and tree cover can help minimize erosion and reduce the vulnerability of farming communities to future flood events. Overall, targeted policy interventions are essential to safeguard the agricultural sector and enhance the resilience of rural communities in flood-prone areas like Bagalkot district.

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