



POVERTY AND LANDSLIDE: A STUDY FROM THE LANDSLIDE PRONE AREAS OF IDUKKI RURAL VILLAGES

Anees Rehman A¹, S Boopathi²

¹PhD Research Scholar, Department of Economics, Bharathiar University

²Professor and Head, Department of Economics, Bharathiar University

ABSTRACT

The poverty is a major risk driven factor for the socio- economic and environment losses of the landslides. The study mainly focused on the how the landslides made an impact on the people who fall under the poverty lines such as above poverty line (APL) and the below poverty line (BPL). Out of the total samples (312), there are 133 respondents fall under the BPL and the rest of them, 179 respondents fall under the APL families. The statistical tools such as mean, standard deviation, Chi square, ANOVA and the t-test were used to find out the comparative differences between APL and BPL families. The study found that, the poverty is a major risk driven factor for the socio- economic and environment losses of the landslides in the study area and the people belonging to the BPL families were affected and changed their standard of living, income earning activity and other major economic parameters.

KEYWORDS: Landslides, Economic loss, Poverty, Idukki district

INTRODUCTION

According to WHO, there is around 90000 people have been killed and nearly 160 million people directly affected by natural hazards. Natural hazards mainly include earthquakes, volcanic eruptions, hurricanes, tsunamis, floods, wildfires, landslides, drought and, heatwaves. Natural disasters are classified as hydro, meteorology, climatic, geophysical and biological causes. All these types of natural disasters affect the people and the environment in different ways as directly and indirectly. Which affects the physical life of people, environmental condition and its balance and other economic activities like price hike, unemployment situation, different kinds of losses to government and the private. landslides are considered as one of the dangerous disasters which facing our nature nowadays. Simply landslide is defined as it is a generic term for the mass movement of earth material (Marten Geetsema et al 2009). Landslides through soil lost is considered as a major climatic related issue and is exhibits huge human and economic losses (GRSRC Samaraweera et al 2012). The magnitude of landslides has a huge amount of destructive power which makes long-lasting effects on the environment. The impact of landslides may affect the elements like the topography of earth's surface, the character and quality of rivers, streams and groundwater flow, the forests, habitats of natural wildlife. This disaster causes environmental societal and economic problems on the people their life and other developmental activities, infrastructure like roads, transportation, and communication. The occurrence of landslides causes a series of threats to humans and other socio-economic life they were mostly lived in the hilly region.

The poverty is a risk driven factor for the people who are living in the environmentally vulnerable areas. One of the important economic problems of people living in environmentally sensitive areas is their low income and thereby the poverty problems they face. Many people who lived there before the landslides face great financial difficulties. All the studies in this field show that impoverished people mainly live in such environmentally sensitive areas. One finding of this study reinforces that. In this area where these poor people live, their standard of living is also low. Because the cost of their space is very small and the work, they do is mostly dependent on nature. There a situation where even if there is a big rain, their regular income is interrupted. Understandably, these kinds of things push them into more trouble and more vulnerable forms of poverty.



METHODOLOGY

The study mainly focused on the how the landslides made an impact on the people who fall under the poverty

lines such as above poverty line (APL) and the below poverty line (BPL). For this analysis, 312 samples were collected from the prone areas of Idukki district on the basis of multistage stratified proportionate random sampling techniques. There are 133 respondents fall under the BPL and the rest of them, 179 respondents fall under the APL families. The statistical tools such as mean, standard deviation, Chi square, ANOVA and the t-test were used to find out the comparative differences between APL and BPL with respect to the impact of landslides in the study area.

Independent t test

$$t = \frac{m_A - m_B}{\sqrt{\frac{S^2}{n_A} + \frac{S^2}{n_B}}}$$

here, A and B are two groups, $m_A - m_B$ are the means of two groups and n_A and n_B are the size of groups

RESULTS AND DISCUSSION

The major results of this study deals with the economic loss of APL and BPL group, changes in annual income, displacement of the respondents and the vulnerability of their living condition.

Table 1- Dimensions of Economic Loss

Poverty Line	Descriptive Statistics	Loss on House Damage	Loss on contamination	Loss on Furniture Damage	Loss on Home Appliances Damage	Loss on Food Grains Damage	Loss on Damage on Land Loss	No of Man Days Lost	Income loss on man day loss
BPL	Mean	64665.4135	5450.3759	6035.3383	3980.4511	1407.8947	404323.3534	113.7519	28832.4812
	Sum	8600500.00	724900.00	802700.00	529400.00	187250.00	53775006.00	15129.00	3834720.00
	SD	125241.	6678.52306	11963.67732	10603.96194	4002.36124	627102.12695	84.21171	24017.75046
	N	133	133	133	133	133	133	133	133
APL	Mean	102125.6983	6470.9497	9857.5419	5359.2179	1037.1508	354100.5587	83.3911	23162.0447
	Sum	18280500.00	1158300.00	1764500.00	959300.00	185650.00	63384000.00	14927.00	4146006.00
	SD	175881.09814	96618611.649	15977.71927	10207.16654	1424.57454	607246.35520	80.57339	20853.80686
	N	179	179	179	179	179	179	179	179
Total	Mean	86157.0513	6035.8974	8228.2051	4771.4744	1195.1923	375509.6346	96.3333	25579.2500
	Sum	26881000.00	1883200.00	2567200.00	1488700.00	372900.00	117159006.00	30056.00	7980726.00
	SD	157184.02679	7850.61448	14506.79315	10383.76424	2827.41391	615291.65297	83.37760	22397.09271
	N	312	312	312	312	312	312	312	312
ANOVA		4.381*	1.291 ^{NS}	5.372*	1.347 ^{NS}	1.312 ^{NS}	0.508 ^{NS}	10.424***	4.953*

Source: Primary Data.

The landslide drastically hit both the BPL and APL families. The differences in the loss have diversified between the two poverty categories. Majority of the BPL families are residing in the more vulnerable area when comparing to the APL group of families. The data shows that damage of house is low under BPL when comparing to the APL. This is because the value of the house as well as the area of house is low. The table containing the details of housing pattern shows that, the value of the house at the period of construction is 281992 rupees for BPL and 434927 rupees for APL. This is a determining factor for the intensity of the house damage during landslide. The area of house is another considerable factor for the damage cost of the house. Secondly, the damage cost on the furniture. This is also low in BPL families. It has two reasons. First is the economic value of the items and the type of destruction of the house. The APL families holds more valuable items than the BPL families, it will increase the value of damage during the time of disaster. The second concern is whether the house is fully destroyed, partially destroyed, or crack. If the house is fully destroyed, all the items in the house will collapsed. Except the land loss, APL families are suffered with more loss as well the type of damage as full destruction of their house. Under the BPL category the average loss of the house damage is 64665.4 rupees and 102125.69 under the APL category respectively. In the case of furniture loss, the loss of damage is 6035 for BPL and 9857 for APL respectively. The same pattern can see in the case of the damage of home appliances. The average of rupees 3980 is calculated as the loss of BPL from home appliances. The loss of APL is 5359 rupees.

The most tragic loss of the landslide is land loss. BPL families are mostly suffered with the huge loss of land. This has made them landless after the landslide in the study area. Only the economic loss of land



determined that, BPL is economically affected more than the APL families. Majority of the BPL families are living in the near of the hill side, which is more exposed to landslide and flash flood. In the same place, they are also cultivating the agricultural crops. So, the landslide in those areas severely affected the BPL families in the form of land loss and crop loss simultaneously. According to the data, average 404323.35 rupees is calculated as the land loss of the BPL families. In the case of APL families, the average loss of land is 354100.55 rupees. In addition to these losses, loss of employment days and income loss is a major factor which influenced the total economic loss of the victims in the study area. in this case BPL families are affected more than the APL families. During the survey, the researcher found that, many people have lost their jobs after the landslide or they converted their actual job into another one. This has severely affected their economic way of life.

Table 2- Changes in the annual income of the respondents due to the landslides

Poverty Line	Descriptive Statistics	Monthly Income	Percapita Income	Annual Income Before Landslide (Total)	Annual Income after Landslides (Total)	Difference in Annual Income	Total Loss	Percapita Loss
BPL	Mean	9619.39	2761.61	166962.90	122640.5639	44322.3383	567296.69	176056.31
	SD	5073.13	1470.42	94400.09	62108.65742	59760.70546	748889.87	237096.56
	N	133	133	133	133	133	133	133
APL	Mean	11726.94	4353.51	177062.1285	150148.2737	26913.8547	556878.99	231096.92
	SD	7432.39	2480.05	99980.98815	91428.98981	48778.66908	698199.19	314595.63
	N	179	179	179	179	179	179	179
Total	Mean	10828.53	3674.91	172757.0096	138422.2308	34334.7788	561319.87	207634.10
	SD	6605.31	2249.39	97614.76333	81285.37328	54332.17576	719079.56	285041.02
	N	312	312	312	312	312	312	312
ANOVA		7.942***	43.431***	0.816 ^{NS}	8.962***	8.010***	0.016 ^{NS}	2.862*

Source: Primary Data

The table shows that, monthly income, changes in the annual income, total loss and Percapita loss met by the respondents in the study locality. The average monthly income of the APL family is 11726.9 rupees and the BPL is 9619.39 rupees. This is the present income of the affected people. Due to the landslide loss, the victims lost a major portion of their income from their occupation based on plantation works and agriculture. The majority of the respondents having considerable earnings from the agriculture and it enhanced their annual earnings. The loss of agriculture in the study area was drastically reduced their seasonal crop income and it directly affected in the reduction of their annual income. The average income before the landslide of the BPL is 166962.90 rupees. But it has reduced to 122640.56. The reduced portion of the annual income was 44322.33 rupees. That is 26.54 percentage of the total annual income before the landslide. It is in the case of BPL families. The annual income of the APL family before the landslide is 177062 rupees, but after the landslide, it was shrunk to 150148 rupees. A difference of 26913.85 rupees has appeared. When comparing to the annual income changes of BPL and APL, the BPL family affected badly. Their change in income is 44322.33 rupees. They have faced more seasonal crop loss when comparing to the APL families. The seasonal crop was the major annual income source of the poor families in the study area. The creepy landslide hit every source of income from the crops.

In the case of total loss, The BPL family met an average loss of 567296.69 rupees and the APL family met an average loss of 556878.9 rupees. There is not much variation between the two poverty groups. The loss of land and agriculture was much higher in the case of BPL family, that is why the BPL having slightly higher loss than the APL group. When considering the Percapita loss, the highest loss is visible in the category of APL because of the lowest number of family members in the APL family. The average number of family members in the APL is 2.84 and 3.68 in the case of BPL families.

Hypothesis I: The BPL families are living in more vulnerable to landslide area when comparing to the APL households.

Null Hypothesis (H₀): There is no difference in the vulnerability living conditions with respect to the BPL and APL households

Alternative Hypothesis (H₁): There is difference in the vulnerability living conditions with respect to the BPL and APL households



Hypothesis Result 1

Group Statistics					
Proximity of the house from the prone area	Poverty line	N	Mean	Std. Deviation	Std. Error Mean
	BPL	133	2.7011	3.02757	.26252
APL	179	3.8916	3.75092	.28036	
Land value	BPL	133	39766.9173	26068.56845	2260.43156
	APL	179	47793.2961	32434.14693	2424.24196

Independent Samples Test										
Factors determining the vulnerability		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Proximity of the house from the prone area	Equal variances assumed	10.445	.001	-3.004	310	.003	-1.19054	.39626	-1.97024	-.41084
	Equal variances not assumed			-3.100	307.844	.002	-1.19054	.38408	-1.94629	-.43478
Land value	Equal variances assumed	18.632	.000	-2.346	310	.020	-8026.37880	3421.7511	-14759.17358	-1293.5840
	Equal variances not assumed			-2.422	308.057	.016	-8026.37880	3314.5889	-14548.47747	-1504.2801



The vulnerability living conditions means that how close these families are exposure to the frequently landslide areas. It can be identified through the proximities of their house from the event place. Generally speaking, the BPL families are living in more vulnerable or in high prone areas when comparing to the APL families. In many ways, the poor peoples are excessively haunted by the natural calamities and they are more exposed to natural shocks (Stephanie Hallegatte et al, 2020). On the basis of this, it should justify there is any difference in the living condition of the APL and BPL households with respect to environmental vulnerability to landslide on the basis the proximities of their houses to the event place. For this, ‘t’ test has been used to test the hypothesis. The result says that, the average proximity of the BPL families to the landslide event place is only 2.7 Kms. In the case of APL families, the proximity is much higher, that is an average of 3.8 Kms. The value of the land is another factor showing the vulnerability of the place. The average price of the land where the BPL families are residing is 39767 and APL is 47793 rupees respectively. This result justified that; the BPL households are living in more vulnerable areas when comparing to the APL households. Finally, there is difference in the vulnerability living conditions with respect to the BPL and APL households. So, this mean variation is much enough to reject the null hypothesis and accept the alternative hypothesis.

Table 5- Present living area of the respondents

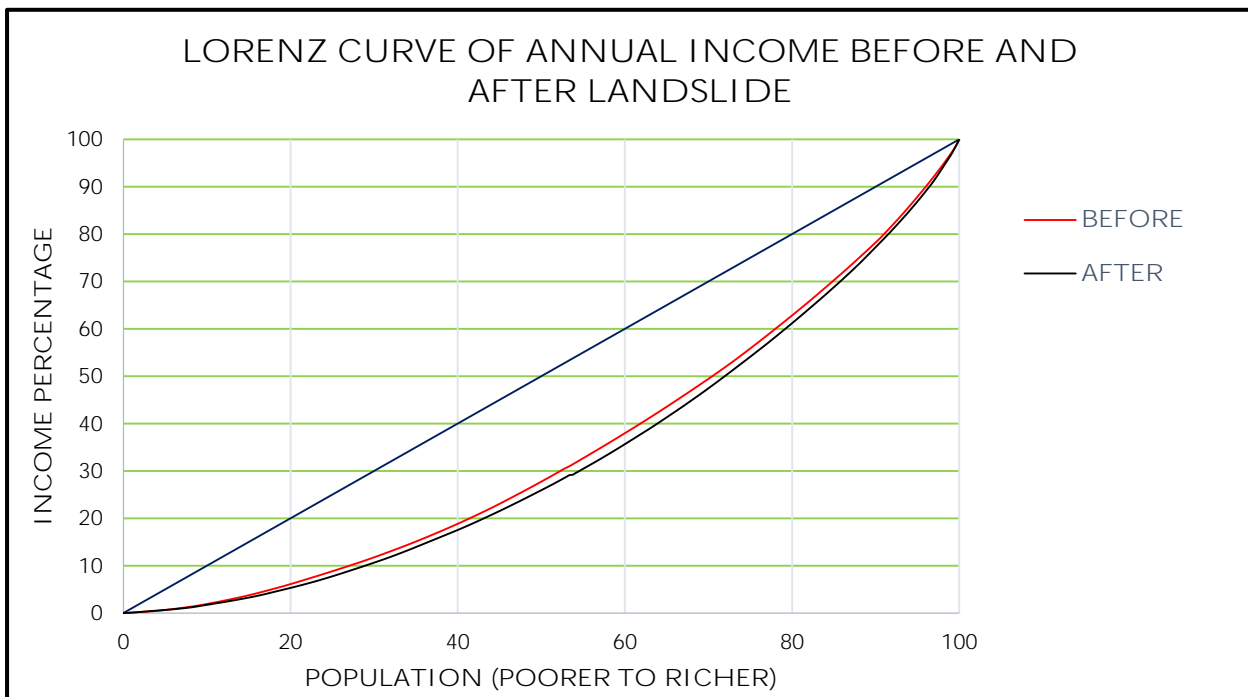
Poverty Line	Prone or non- prone area At present		Total	Descriptive Statistics	Price of the plot per cent	Distance from the prone area
	Prone area	Less prone area				
BPL	109	24	133	Mean	39766.91	2.70
	82	18	100	SD	26068.56	3.02
	45.8	32.4	42.6	N	133	133
APL	129	50	179	Mean	47793.29	3.89
	72.1	27.9	100	SD	32434.14	3.75
	54.2	67.6	57.4	N	179	179
Total	238	74	312	Mean	44371.79	3.38
	76.3	23.7	100	SD	30105.40	3.50
	100	100	100	N	312	312
Chi-Square	4.123*			ANOVA	5.502**	9.207***

The table says that the present living area of the BPL and the APL families after the landslides. There is more than half of the samples still living in the landslide prone area. That is 76.3 percentage of the total sample population. When comparing to the price of the plot and its distance from prone area, the average price of the plot is 39766.9 rupees in the case of BPL and 47793.2 rupees in the case of APL families. It is evident from the fact that, the value of the plot is directly related to the distance of the area from the landslide event place. When the distance from the prone area is 2.7 Kms, the plot price is 39766 and the price increased to 47793 rupees as the distance increased to 3.8 Kms. Precisely, the ANOVA proves the same significant variation between plot price and the distance from the landslide prone area.

According to the distance from prone area and plot price, both are low in the case of BPL families. It is possible to infer that, BPL families are residing in close proximity of the landslide prone area comparing to the APL families.



The Lorenz Curve of changes in the annual income of the respondents,



(Primary Data)

The Changes in the annual income has been depicted with the help of Lorenz curve which showing the income inequality has been increased after the landslide in the study area based on the annual income. The major source of their annual income is agricultural income. The drastic landslide has been made huge loss in the agricultural field and it led to the huge financial loss in uneven distribution. It has led to the increased income inequality in the study area after the landslides in terms of the annual income.

CONCLUSION

The study concluded that, The BPL families are more vulnerable and exposed to the landslide in the study area. The effective resettlement policy is the major policy implication should carried out by the government authorities. The present study also discovered the uneven distribution of the government approach to the APL and BPL families they met the economic losses. The study found that, the poverty is a major risk driven factor for the socio- economic and environment losses of the landslides in the study area and the people belonging to the BPL families were affected and changed their standard of living, income earning activity and other major economic parameters.

REFERENCES

1. Prihantini C. *Estimating the Economic Losses Value Caused by Flood Disaster in Sampang Regency Using Tangible Damage Assessment*. IOP Conference Series: Earth and Environmental Science. 2020;469(1):012091.
2. Danh VT, Mushtaq S. *Living with floods: An evaluation of the resettlement program of the Mekong delta of Vietnam*. In: *Advances in Global Change Research*. Dordrecht: Springer Netherlands; 2011. p. 181–204
3. Yalcin, A. "Environmental Impacts of Landslides: A Case Study from East Black Sea Region, Turkey." *Environmental Engineering Science* 24, no. 6 (July 2007): 821–33. <https://doi.org/10.1089/ees.2006.0161>.
4. Patra, P., and R. Devi. "Assessment, Prevention and Mitigation of Landslide Hazard in the Lesser Himalaya of Himachal Pradesh." *Environmental & Socio-Economic Studies* 3, no. 3 (September 1, 2015): 1–11. <https://doi.org/10.1515/environ-2015-0062>.