

Impacts of Drought on Household Food Security: Evidence from Rural Sri Lanka

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INTRODUCTION

Drought mainly occurs due to extremely lower precipitation than the mean precipitation for a prolonged period in a particular area that may arise in the form of irregular patterns or lack of rainfall. It significantly affects agriculture, the environment, the economy, and other social activities. The effects are spread over a wider geographical area, which caused the impact of drought to be higher than the other disasters (Wilhite, 2000). If the impact is given in monetary terms, those impacts are called economic impacts, which cause to hinder economic opportunities, including increasing poverty due to crop failure, yield reduction, and increased artificial irrigation. In addition, many social impacts of drought have been reported, such as health and safety of the people, including disease incidences due to the reduction of the quality water, arising conflicts for limited resources, and altering the routine lifestyle compatible with the droughts. Along with these adverse consequences, drought directly or indirectly affects food security¹, which can be implied with four components: availability, accessibility, utilization, and stability.

In Sri Lanka, a country closer to the equator, drought occurs primarily in the dry zone and intermediate zone. According to the Disaster Management Centre records, 2,440,290 drought-affected people within 667,939 families were recorded in 21 districts which was the highest impact among all-natural disasters in 2017 (Disaster Management Center, 2017). Furthermore, lack of quality water for drinking and household uses and inadequate water for irrigation have been reported in Northern, North-Central, and Eastern Provinces

¹ Food security is defined as a situation that exists “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (Food and Agriculture Organization, 2021).

(United Nations Office for the Coordination of Humanitarian Affairs, 2017).

Even though the reported impacts are apparent and well known, many factors are left to be recognized. Moreover, the reported evidence regarding the community's view was poorly acknowledged. It is vital to see the impacts of drought hazards from the community's perspective.

Thus, the present study aims to identify the impacts of drought on household food security. The specific objectives are to identify household perceptions on the socio-economic impacts of droughts and evaluate whether the identified socio-economic impacts of drought lead to food insecurity.

METHODOLOGY

The study has two major parts. The first part was carried out using the secondary data published by the research project on 'North Central Province Drought Research Project, Department of Environmental Management, Faculty of Social Sciences and Humanities of the Rajarata University of Sri Lanka in 2017. The project was conducted in eight divisional secretariat divisions (DSDs) in *Anuradhapura* district. The stratified random sampling method was used to obtain a representative sample. Among the 23 DSDs in the *Anuradhapura* district, 70 households from eight DSDs were selected randomly to get a sample of 560, and 533 completed questionnaires were obtained with a response rate of 95.2%. A pretested self-administered questionnaire was used to collect data. The present study utilized the sections including socio-demographic information and perceptions of the impact of drought on food security with a 5-point Likert scale.

Since the data belonged to the ordered category, non-parametric analysis, Sign test was performed to analyze the data. All the adverse impacts of drought included in the questionnaire were developed to get a perception from 5 choices (1=strongly disagree, 2=disagree, 3=moderate, 4=agree, and 5=strongly agree) using the Likert scale. During the analysis, we tested where the affected community favored the perceptions 3 (moderate), 4 (agree), and 5 (strongly agree). Nine different hypotheses were constructed to perform the statistical test-taking the null hypothesis as " i^{th} impact ($i = \text{impact } 1, 2, \dots, 9$) was not perceived during drought period" ($H_0: \text{median perception} < 3$).

Normal approximation (equation 1) was accomplished as the sample size was more than 30, and the calculation was done manually.

$$Z = ((S - 0.5) - 0.5n)/(0.5\sqrt{n}) \quad (1)$$

Where,

S = number of sample measurements greater than the median

n = number of samples not equal to the hypnotized value

The obtained Z values were compared with the critical value of 1.96 to test the null hypothesis.

Further, we performed Mann-Whitney U test and Kruskal Wallis H test to see whether there is a statistically significant difference in the perceptions among respondents.

The second part was a narrative literature search conducted to identify how the socio-economic impacts of droughts (used in the first section of the study) lead to food insecurity as reported in global literature.

FINDINGS

Socio-demographic profile of the study sample

The mean (SD) age of the participant was 51 (± 5.8) years, and the primary income-generating activity of the majority (n=480, 90.1%) was farming. The majority (n=358, 67.2%) had up to Ordinary Level education. The highest value of average land size owned by respondents was mud paddy, followed by home garden and chena. Further details on the socio-demographic background are presented in Table 1.

Table 1: Socio-demographic profile of the study sample

Variable	Categories	Values
Education level of the household head (%)	No schooling	20 (3.8%)
	Primary	67 (12.6%)
	GCE O/L	358 (67.2%)
	GCE A/L	87 (16%)
	Graduate	1 (0.1%)
Occupation (%)	Farming	480 (90.1%)
	Other	53 (9.9%)

Average land size (Acre)	Mud paddy	1.77
	Up paddy	0.27
	Chena	0.95
	Commercial crops	0.04
	Home garden	1.04

Impacts of drought

Nine major impacts were taken into the analysis; decreasing harvest, decreasing the cultivable lands, changing the land use pattern, changing the food pattern, scarcity of food, inadequate drinking water, declining the water quality, decreasing the income opportunities and reduction of money savings. According to the Sign test conducted on impacts of drought, all impacts were significant ($Z > 1.96$) at the 95 percent confidence interval (Table 2).

Table 2: Perception of socio-economic impacts of droughts

Impacts	Frequency [n (%)]		Z value	Test Result
	Group 1 (Perception on 1 and 2)	Group 2 (Perception on 3,4 and 5)		
1 Decreasing harvest	1 (0.2%)	532 (99.8%)	22.9568	Significant ($Z > 1.96$)
2 Decreasing the cultivable lands	5 (0.9%)	528 (99.1%)	22.6103	
3 Changing the land use pattern	18 (3.4%)	515 (96.6%)	21.4841	
4 Changing the food pattern	31 (5.8%)	502 (94.2%)	20.3579	
5 Scarcity of food	17 (3.2%)	516 (96.8%)	21.5707	
6 Inadequate drinking water	8 (1.5%)	525 (98.5%)	22.3504	
7 Declining the water quality	32 (6.0%)	501 (94.0%)	20.2713	
8 Decreasing the income opportunities	26 (4.9%)	507 (95.1%)	20.7911	
9 Reduction of money savings	34 (6.4%)	499 (93.6%)	20.0980	

The Mann-Whitney U test revealed that there is no statistically significant difference ($U=92,939.5$, $|z|=0.263$) between respondents who do farming as an occupation and their counterparts. Also, the Kruskal Wallis test indicated the same result among different education groups ($\chi^2=4.266$, $p=0.234$) and farmland sizes $\chi^2=1.926$, $p=0.588$).

The socio-economic impacts of drought leading to food insecurity

This section aims to identify how the former indicated socio-economic impact of drought leads to food insecurity as reported in global literature. The households' perceptions in the above section are apparent when each impact is conferred in literature.

Decreasing harvest - Due to the water availability in the soil and higher evapotranspiration, demand for water by any cultivation is increased, which is not easily met by providing irrigated water in drought conditions. Consequently, the particular crop fails to give its maximum yield (Wilhite, 2000), reducing households' food availability (Napoli et al., 2011).

Decreasing the cultivable lands and changing the land use pattern - When the moisture level of topsoil is reduced, the crop's root system cannot absorb enough water even for survival (Pandey et al., 2007). Organic matter is also depleted as water retention capacity is poor, generating less fertile soils (Katalakute et al., 2016). Thus, the land becomes barren, creating long-term adverse impacts on agriculture and ultimately on the economy (Pradhan et al., 2017). When long-term drought occurs, cultivating high water-demanding crops is not possible in particular lands (Pandey et al., 2007). Consequently, farmers prefer alternatives to avoid crop loss resulting in the earlier used crop. Hence, the traditional land use pattern is changed (Udmale et al., 2014). With these circumstances, food availability is declined, and food accessibility is also reduced due to the increased food expenditure (Pandey et al., 2007; Napoli et al., 2011).

Decreasing the income opportunities - The reduction of income sources such as crops, livestock, and fisheries due to severe drought creates unemployment of farmers, causing the households' inability to purchase food, leading to the utilization of savings for food needs (Udmale et al., 2014). In addition to that, the middlemen from farm to table, including suppliers, transporters, buyers, and sellers are affected,

leading to the lowering of food accessibility (Pandey et al., 2007; Sajjad and Nasreen, 2014). Hence, food insecurity is created due to the reduced accessibility of food sources.

Scarcity of food and changing the food pattern - The reduced yield due to the drought leads to famine (Udmale et al., 2014; Katalakute et al., 2016), resulting in food, poverty, leading to the reduced food accessibility (Sajjad and Nasreen, 2014). Further, people have to alter their food patterns to the low-level dietary pattern since they cannot achieve their essential food types (United Nations Office for the Coordination of Humanitarian Affairs, 2017) leading to reduced food utilization (Napoli et al., 2011; Pangaribowo et al., 2013).

Inadequate drinking water and declining water quality - People in dry zone areas mainly use tube well water for drinking purposes (Amaraweera et al., 2018). With the long-lasting droughts, the groundwater level is decreased, resulting lower amount of accessible water (Pandey et al., 2007). Due to the seepage of heavy metals into the groundwater, the drinking water quality is also reduced, harming the quality of food utilization (Habiba et al., 2011), leading to increase food insecurity. Thus, diseases also rise due to the low-quality water in addition to the intolerable heat (Friel et al., 2014).

The considered impacts of this study's first component could reduce availability, accessibility and utilization of food according to the global level evidence. If the availability, accessibility, and utilization of food exist for an extended time due to the long-lasting droughts, food stability also can be affected, which is the other component of food security (Pangaribowo et al., 2013).

CONCLUSIONS

According to the rural Sri Lankans' perceptions, drought negatively affects food security-related factors. According to the global level evidence, these factors can lead to food insecurity. More details and context-specific approaches are required to combat the adverse impacts of drought on food insecurity. The present study highly recommends conducting further studies to see whether the socio-economic implications of droughts lead to food insecurity in rural Sri Lanka.

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