

**ECONOMIC COSTS OF DROUGHT AND
FARMERS' ADAPTATION STRATEGIES:
EVIDENCE FROM SRI LANKA**

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Abstract

Sri Lanka, a country in the tropical region, has experienced cyclical droughts of high intensity, occurring in intervals of three to four years. These droughts have had a series of adverse impacts on the economic and social life of people in the country. This study attempts to assess the economic costs of drought and farmers' adaptation strategies to drought with the intention of informing the policies which address drought-related economic vulnerability among farm households in Sri Lanka. Data were drawn from 540 farm households in the North Central Province (NCP) in the dry zone of Sri Lanka, in 2015. Results indicate that drought weakens agricultural production, food consumption and the investment capability of farm households, while also increasing indirect costs such as those arising in relation to healthcare. Thus, immediate measures, particularly income mediating policies to provide compensation to drought-affected families, are required to avoid multiple impacts of drought to farm households and to the provincial economy.

Key Words: *Drought, Economic Vulnerability, Farm households, North Central Province, Sri Lanka*

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BACKGROUND AND RESEARCH SUBJECT

Competition in the global economy has intensified in light of climate change worldwide, adversely affecting the people living on earth. Climate change is the result of global warming. Recent studies have revealed an increase in temperature change, which indicates a direct link between global warming and emission of greenhouse gases such as carbon dioxide (CO₂) and nitrogen oxides (NO₂) (Goel & Bhatt, 2012). These emissions are mostly negative externalities of global economic activities. According to a 2014 Intergovernmental Panel on Climate Change (IPCC) report, the severity and occurrence of extreme weather events such as drought and floods have increased during the last few decades (Intergovernmental Panel on Climate Change, 2014).

A drought is a temporary meteorological event that stems from a deficiency in rainfall over an extended period of time, relative to long-term average conditions (Habiba, Shaw, Wali, & Hassan, 2013). Sri Lanka, a country in the tropical region, has experienced a cyclical trend of drought, occurring at high intensity in three- to four-year intervals. During the last three decades, several major droughts were reported in 1983, 1986, 1989, 1996, 2000, 2009, and 2013/14 (Disaster Management Center, Sri Lanka, 2013).

These droughts created a series of adverse impacts on the economic and social life of people in the country. In recent decades, droughts caused the biggest damage to the country's agriculture; surpassing other natural disasters such as floods, landslides, epidemics, and tsunamis. For instance, droughts have accounted for 52.2% of crop losses, which is the highest percentage recorded in a single natural disaster during the period from 1974 to 2013 (Disaster Management Center, Sri Lanka, 2013). In 2013, 1.5 million farmers were affected by drought.

Table 1 clearly shows the weakened performance of key economic variables—economic growth, contribution of agricultural sector and other sectors to gross domestic product (GDP), inflation, agricultural exports, food imports, balance of payment—during years in which droughts were reported and those immediately thereafter. As evident in literature, drought weakens production capabilities in agriculture, which gives rise to supply-side shocks to the economy. On the other hand, droughts adversely affect the performance of other economic sectors, mainly the output of the industrial sector, because 60% of the country's energy requirement is met through hydropower generation.

Thus, the supply side shocks (reduction in aggregate supply) weaken the performance of key variables in the economy, as evident in Table 1.

Table 1. Performance of economic variables during drought and normal years

Key Indicator		1989	1992	2001	2004	2013
Economic Growth		2.3 (2.1)	4.3 (5.4)	-1.5 (4.9)	5.4 (5.0)	7.3 (7.25)
Contribution to GDP	Agriculture	-1.1 (-3.7)	-1.6 (3.15)	-3.4 (3.15)	-0.7 (2.05)	4.7 (3.3)
	Industry	4.4 (5.75)	8.8 (8.1)	-2.1 (5.95)	5.2 (3.25)	9.9 (10.3)
	Service	3.2 (2.45)	5.3 (5.25)	-0.5 (5.5)	7.6 (7.0)	6.4 (6.6)
Food Imports (billion US \$)		284.4 (217.35)	297.9 (300.15)	654 (674)	1623 (1088.5)	1368.1 (1435.65)
Agricultural Exports (billion US \$)		477 (464)	429 (499.5)	932 (976)	1065 (951.5)	2581.1 (2429.65)
Inflation		11.6 (10.85)	11.4 (16.85)	14.2 (5.45)	7.6 (7.95)	6.9 (7.15)

Source: Central Bank Report, various issues

Note: Parameters indicate two years' average value of economic variable before drought year

Though many studies attempt to assess the macro-level impact of drought, few take place in a local setting. Drought is a complex natural phenomenon and takes place largely in a local setting: hence an economic impact assessment of drought in the local context is vital as those assessments could provide information in formulating long-term policies to address adverse impacts of drought at local- and national-levels.

Therefore, this study attempts to assess the economic costs of drought and farmers' adaptation strategies to drought with the intention of informing appropriate policies which address drought-related economic vulnerability among farm households in Sri Lanka. In this connection, the study addresses following points: 1) assessment of severity of economic vulnerability of farm households to drought, 2) investigation of economic cost of drought to farm households, and 3) examination of types of coping mechanisms adopted by farm households.

LITERATURE REVIEW

The economic impact of drought has gained interest among scholars and development practitioners in the recent past due to its likely impact on key economic variables such as economic growth, gross domestic product, budget expenditure due to expenditure on relief and compensation programs, and food import bill. Several disciplinary areas have been recognized in the literature assessing the impact of drought on the aggregate economy and on distinct communities such as farming. For instance crop yield, cultivated area, farm income, employment, savings, investment and

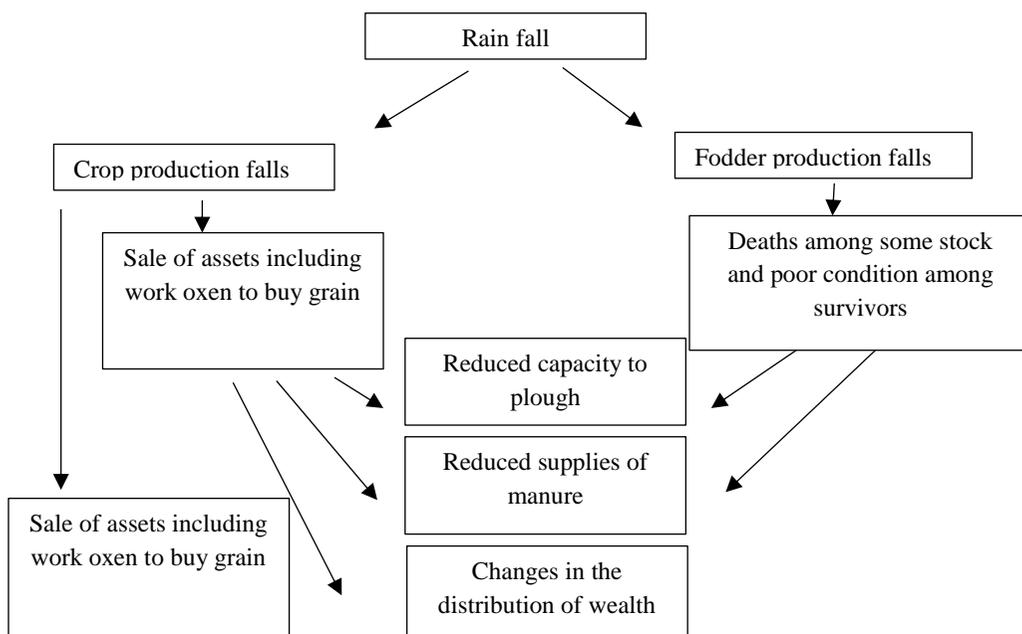
consumption, health issues, education, and training are the recognized variables highlighted in the literature concerning the farming community.

Yinpeng et al. (2009) have assessed the drought risk for world food production by considering current and future climate conditions. The study has integrated the natural, social, and economic components to analyze climate change risk on drought and food production. The relationship between crop yield and drought has been established employing specified linearized regression model using historical data on meteorological drought and country-specific crop yields. The study findings noted that crop-land drought disaster risk would double by the end of the 21st century due to intensifying global warming. Further, results projected the increase of the YRR (Yield Reduction Rate) for major crops of the world due to drought: with sorghum and maize crop zones being particularly vulnerable to future drought risk due to increasing global warming. These crop zones are mostly located in less-developed countries, and thus have fewer adaptation strategies to face the adverse impacts of drought on food production. Thus, food security at the national and local settings, particularly in less developed countries, would be the prime concern in future at policy-making level.

Udmale et al. (2015) have evaluated the impact of drought which occurred in 2012 and impacted farming communities in Maharashtra State in India in terms of domestic water supply, agriculture, unskilled rural labor, and financial status of rural households. This study used a field survey method involving 223 farm households in Upper Bhima catchment in May 2013, and a structured questionnaire to gather data.

The study revealed a severe problem of drinking water among farm households, which resulted in increased time spent over water collection, thus limiting employment opportunities and social activities. A decline of agricultural production, of about 86%, was reported due to drought. Households with rainfed farming systems, small to marginal land holding size, and low incomes were the most vulnerable groups to drought. Households with both irrigated and rainfed farming systems, large land-holding size, and high income could mitigate the adverse impact of drought, specifically in terms of food insecurity.

Toulmin (1986), writing a network paper on behalf of Food and Agriculture Organization (FAO), has outlined the effects of drought on farming areas (see Figure 1). The report states that the most immediate effect of drought is the decrease in farm production and the resulting increase in food insecurity. The increased food insecurity due to the meager harvest at farm household level leads (first) to the sale of livestock as a buffer in time of hardship though drought reduces value of livestock. This condition could be seen in less-developed countries, specifically in Sub-Saharan Africa and South Asia.

Figure 1: Effects of drought on farming areas

Source: Toulmin (1986)

Pandey, Bhandari, and Ramesh (2004) performed an analysis on the economic cost of drought and rice farmers' coping mechanisms using time series data and farm survey data in China, India, and Thailand. The estimation showed the economic cost as 2-6% of the value of output. The study has further revealed the inadequacy of coping mechanisms of farmers in preventing consumption shortfalls. According to Pandey and Bhandari (2007), the average production losses for rice during a drought year is 44% compared with those of a normal year in the Philippines.

The study further noted that the severity of drought impact on crop yield is dependent on various factors such as irrigation infrastructure, agro-ecological conditions, drought-resistant crop varieties, and crop and land management strategies. The study further stated that farmers could maintain their consumption level during the drought period since they can earn an off-farm income. However, this depends on the healthy growth of the off-farm sector. Pandey and Bhandari (2007) have further revealed that people utilize their savings to maintain their consumption levels during the drought period, particularly resource-poor and low-income groups in drought-affected regions. In fact, with no adequate savings for contingency, those groups are more vulnerable during the drought period in terms of food insecurity, children's education, and business investments.

The studies have paid less attention to the economic cost of people's health issues in drought-affected areas, and most scholars have outlined the complexity in determining the economic cost of drought-related health issues. By conducting a comprehensive literature review, Stanke et al. (2013) have identified five types of health issues associated with drought: i.e., nutrition-related effects, water-related diseases, air-borne and dust-related effects, vector-borne diseases, and mental health effects. This study emphasized the need to consider direct and indirect costs of drought-related health issues in the economic assessment.

Alston and Kent (2004) and Travis and Klein (2012) have identified drought as a factor of employment decline, particularly in the agricultural regions. Specifically, these studies have revealed that drought results in downgrading seasonal employment opportunities in agriculture, especially to women. According to a study in the Queensland Central Coast and the Riverine conducted by Aslin and Russell (2008), drought resulted in declined employment in agriculture by 20.6% and 8.8% respectively, over a five-year period ending in 2006.

In the Sri Lankan context, researchers have paid less attention to assessing the economic impact of drought. A study by Manour and Jayamanna (2014) in a rural community in the central highlands of Sri Lanka found protein-energy malnutrition, skin sepsis, poor oral hygiene, and respiratory disease symptoms, as some drought-related health issues. The research, however, has not attempted to identify the direct and indirect costs of drought-related health issues. A study conducted in three villages in Monaragala district in Sri Lanka revealed that households below the poverty line are more vulnerable to drought (Gillespie, 2011). Specifically, annual and perennial crop losses, crop yield reduction, quality deterioration of produce, income loss of farmers, the difficulty of obtaining loans, and inadequacy of paddy for consumption, are the economic impacts of drought recognized by the study. The study provided empirical evidence on the significance of traditional farming in mitigating the adverse impact of drought.

METHODOLOGY OF THE STUDY

To deal with the research subject, data were drawn from a field survey conducted in the North Central Province (NCP) located in the dry zone of Sri Lanka, in 2015. The NCP was selected as the study area due to the following reasons:

First, the province is historically well-known for agriculture and livestock farming in the country, and over 65% of the people in the province are dependent on agriculture and agriculture-related industries (Prasanna, Bullankulama & Kuruppuge, 2012). The cultivations are under three irrigation systems—major, minor, and rain-fed irrigation systems. A majority of farmers are smallholders with a land area less than one hectare.

Second, the NCP consists of five zones based on socioeconomic and agro-ecological characteristics. This heterogeneity in the province is decisive in understanding the variations of agriculture pattern in the province, and thereby the impact of drought on farming communities would vary across the zones.

Third, the NCP is one of the main drought-affected provinces in 2013/14. For instance, the average rainfall in the region declined to 1,193.1 mm in 2013 from 1,878.1 mm in 2012, which is a 36.4% reduction in annual average rainfall in the standard years. Thus, this typical region helps researchers to assess the economic impact of drought in a rigorous manner.

Method of sampling and data collection

The field study sites were selected by considering five zones determined based on the socioeconomic and agro-ecological factors. Of each zone, typical Grama Niladari (GN) divisions located in the minor and up-land farming systems were chosen for the farmer survey. Minor and up-land farming systems are the most vulnerable to drought as agricultural activities are entirely dependent on rainwater harvesting. Though the study was designed to access all farm households in each GN division, only 80% of farm households were accessed due to difficulties in contacting all farmers because of the socioeconomic characteristics and nature of livelihood activities of farmers in the area. Specifically, the survey encompassed these 540 farm households by giving equal probabilities to all farmers during sampling. Sampled farmers were interviewed by employing a pre-tested survey questionnaire, which was designed to elicit data on normal and drought years. A descriptive statistical method was used to analyze the survey data.

Analytical methods

The economic effects of drought were assessed based on the change of variables—agricultural production and income, household food security, investment and savings, and health cost.

Agricultural Production and Income

Effects on agricultural production and income were assessed using the quantitative acreage loss of yield and income of selected crops. Followings are the calculation techniques applied in estimating the acreage quantitative loss and income of selected crops by the study.

- (1) Acreage Quantitative Loss of Yield of i^{th} Crop = Productivity Change + Crop Loss due to Change of Harvesting Area

1.1. Yield loss due to productivity change = Average acreage production of normal year – Average acreage production of drought year, estimated based on harvesting area

1.2. Yield loss due to change in harvesting area = Average year acreage production * [(Cultivated area – Harvesting area) / Cultivated area]

(2) Income loss = Acreage quantitative loss of yield of i^{th} commodity * Unit price i^{th} commodity in a normal year.

The statistical significance of the difference of these variables between normal and drought years was tested using the Student's t-test.

Household food security

The impact on household food security was assessed using the variable food deficit. Household responses with respect to food security status were obtained under five scales – *always deficit, sometimes deficit, neither deficit nor surplus, food surplus, and no responses*. Coping strategies to address the household level food shortage were categorized and analyzed using the number of households applied each coping strategy.

Savings and investment

The impact on savings and investment were assessed using variables —withdrawals of savings and deviation from scheduled investment plan.

Health cost

The cost of diseases was calculated by considering the opportunity cost of the number of days spent suffering from disease, direct cost, and transport cost.

RESULTS AND DISCUSSION

Socio-economic status of sampled farm households

A majority of sampled farmers (90%) are primarily dependent on agriculture activities and the rest (10%) are dependent on various sources of income such as small and medium business activities, and government and private sector employments. The mean age of a household head is 51 years, implying that most farmers have more experience in farming and are economically active. A majority (77%) of farmers use their own land for farming, while the rest use rented land. Average household size is 3.85, which is closer to national level data, which is 3.9 (Census and Statistical

Department, Sri Lanka, 2014). Almost all surveyed farmers were smallholders with landholdings less than one hectare with about 30 years of farming experience. This indicates limited scope for income generation at the household level, as farming is their main livelihood activity and any adverse shocks to farming may severely affect the economic welfare of these families. According to educational level of sampled farmers, 67.2% of farmers have participated in the GCE O/L exam and 16.3% for GCE A/L exam. It implies that a majority of the farmers have completed primary education.

Table 2: Descriptive statistics of surveyed sample

Variable		Number
Main livelihood activity	Farming	90%
	Other	10%
Average household size		3.85
Mean age of household head		51
Educational level of household head	Zero schooling	20 (3.7%)
	Up to grade 5	68 (12.6%)
	GCE O/L	363 (67.2%)
	GCE A/L	88 (16.3%)
	Graduate	1 (0.2%)
Average land size (Acres)	Mud paddy	1.77
	Up paddy	0.27
	Chena	0.95
	Commercial crops	0.04
	Home garden	1.04

Source: Field survey, 2015

Economic effects of drought

Effects on agricultural production and income

The performed paired t-test confirmed statistically significant change of variables productivity, harvesting area, and unit price of selected crops, between normal and drought years (see Table 3). Therefore, in assessing the effects of drought on agricultural yield loss and income change, change in productivity, harvesting area, and unit price of selected crops were considered.

Table 3 shows the agricultural productivity, harvesting area, and unit price, during normal and drought years. The annual average productivity per farmer for rice and corn were indicated in upper rows in Table 3.

Table 3: Agricultural productivity, harvesting area, and unit price during normal year and drought year

Variable	Normal year	Drought year	Difference	Is the difference significant?
Productivity (per acre)				
Rice	1,470.80	991.60	479.20	***
Corn	1,379.26	417.51	961.75	***
Harvesting area (acres)				
Rice	2.44	0.60	1.84	***
Corn	1.66	0.33	1.33	***
Unit price (per kg)				
Rice	28.96	35.53	6.57	***
Corn	39.25	55.34	16.09	***
Chili	172.86	230.00	57.14	***

Source: Author(s) calculations based on field survey

Note: ***, **, and * indicate significance at 1%, 5%, and 10% respectively.

The productivity of rice has reduced from 1,470.8 kg per acre to 991.6 kg per acre in the concerned season of the study. Corn productivity decreased from 1,379.2 kg per acre to 417.5 kg per acre. In this calculations, the *ceteris paribus* assumption was taken into account. Then the drought was considered as the only determinant of productivity change. The significant difference of productivity in normal and drought years was confirmed by paired t-test at 1% significance level. Average annual harvesting area per farmer for rice was 2.44 acres in normal years, but it decreased to 0.6 acres in drought years. Harvesting area for corn declined from 1.66 acres to 0.33 acres. Reduction of harvesting areas for both rice and corn was confirmed by paired t-test at 1% significance level.

Changes of unit prices occurred in the other way around. Unit prices of all crops increased due to drought. Price of rice increased from Rs. 28.9 to Rs. 35.5, while increase of corn prices were observed from Rs. 39.2 to 55.3. Highest price increment was observed in chili market, which was Rs. 57.14.

Table 4 presents the estimated yield loss during the drought period. Estimated loss of crop yield was calculated by the summation of productivity change (annual average acreage production per farmer) and change of harvesting area. Average quantitative loss of yield due to productivity change was calculated by using equation 1.1, the yield loss due to changes in harvesting areas was calculated by using equation 1.2, and the total yield loss was estimated by employing equation 1.

Table 4: Estimated yield loss during the drought period – Maha Season

Crop	Acreage quantitative loss of yield due to productivity change (kg)	Acreage yield loss due change in harvesting area	Acreage estimated total yield loss
Rice	479.20	581.26	1,060.46
Corn	1,379.26	1,105.07	2,484.33
Chili	424.29	264.25	688.54

Source: Author calculations based on field survey

Highest yield loss was observed in corn cultivation and the lowest in chili. Table 5 shows estimated income loss during the drought period. Income loss was calculated by multiplying acreage quantitative loss of yield by unit price in normal year (equation 2). In terms of rice, which is the staple food of the country and main crop of the farmers in the region, acreage estimated income loss reported as Rs. 30,710.9.

Table 5: Estimated income loss during the drought period

Crop	Acreage quantitative loss of yield (kg)	Unit price at normal year (Rs.)	Acreage estimated income loss
Rice	1,060.46	28.96	30,710.92
Corn	2,484.33	39.25	97,509.95
Chili	688.54	172.86	119,021.02

Source: Author' calculations based on field survey

Impact on household food consumption

Level of consumption during the drought period is crucial in determining the impact of drought on the level of welfare of households. The study found food insecurity at household level during the drought. Table 6 shows self-responses on food insecurity by the households. A 7.1% of surveyed households experienced food deficit always and mostly these households are in the bottom level of the income category of the surveyed sample. According to the views of these farm households, they could not access the food market during drought because the declined income coupled with loss of agricultural income at the household level and increased food prices at the market. Food deficits were experienced occasionally by 44.8% of households whereas the rest of households did not report any decline in food consumption at the household level. In overall, approximately 52% of farm households have had food security problem at

the household level during the drought period. It indicates the need of immediate relief programs to address food shortage at the household level during drought periods.

Table 6: Self-responses on food security status during drought period

Status	No. of households	%
Always deficit	38	7.1
Sometimes deficit	242	44.8
Neither deficit nor surplus	214	39.6
Food surplus	42	7.7
No responses	4	0.8
Total	540	100

Source: Field survey, 2015

Coping strategies adopted by the households to face food insecurity are presented in Table 7. The strategies were having less (32.4%) from favorite foods such as meat and fish, borrowing foods (36.3%), reducing quantity of food taken as meals (18.1%), elders (especially parents) consuming less food (5%), and limiting the no. of meals per day (3.5%). Responses to declining food security by households indicate two possible impacts – 1) adverse impact to household's nutritional status and thereby labour productivity, and 2) increased indebtedness at household level. Thus, it is evident that severe droughts inevitably retard not only short-term growth but also by mid- and long-term growth at the farm household level and thereby affect regional economy.

Table 7. Responses to declining food security during drought period

Type of response	No. of households	%
Having less from favorite foods	84	32.4
Borrowed foods	94	36.3
Reduce the quantity of meal	47	18.1
Elders having less food	13	5
Limit the no. of meals per day	9	3.5
Having no dinner	2	0.9
Having no foods per day	1	0.4
<i>Other</i>		
Save rice from last season for this season	3	1.3
Limit unnecessary expenses	1	0.2
Having alternative foods	4	1.5
Exchange foods	1	0.2
Having any quality food for breakfast, lunch and dinner	1	0.2

Source: Field survey, 2015

Impact on savings and investment decisions

Analyzing the field survey data reveals that 302 farm households had to utilize their savings to address the issues raised during the drought, although they had investment plans before the drought. According to Table 8, 43.5% of farm households had to withdraw their savings to cover food expenditure during the drought period.

As stated at the outset, drought has resulted in reducing the agricultural income of the farm households. Specifically, food expenditure at the household level increases during the drought period due to two reasons – 1) reduce or loss of main (staple) food production at farm level, and 2) increased food prices, particularly rice and vegetables, due to the supply side shocks at the market. Also, 15%, 14.4%, 10.7%, and 3.5%, of households had to use their savings to cover the educational expenditure of children, for emergency purposes, to minimize the impact of harvest loss and to cover health costs due to drought, respectively.

Table 8: Areas of savings utilization to minimize the impact of drought

Savings utilized area	No. of households	%
To cover the food requirements	131	43.5
To cover the educational expenditure of children	53	17.7
To use in an emergency	43	14.4
To minimize the impact of harvest loss	62	20.5
To cover the health cost due to drought	11	3.5
Other	1	0.4

The scheduled investment plans prior to drought indicate that economic growth at household level slow down for a few years because accumulated savings are spent to cover essential household, and to thereby reduce savings at household level. According to Table 9, 9.4% of farm households had plans to purchase new agricultural machineries. At present, mechanization in agricultural fields happens rapidly. Delay in farmers' investment on agricultural machinery may hinder the growth of regional agriculture.

Other areas of scheduled investment are: building a house, buying a vehicle, starting a new business, buying land, covering educational expenditure of children, and expanding trade and self-employment. According to the field survey, inadequacy of savings to cover direct costs of drought was evident from the borrowings of these households. They mainly relied on local money lenders for borrowings with additional conditions such as payback within shorter period, higher interest rate, pay the interest first and settle the loan after, and higher value of instalment, etc. Thus, short-term relief mechanism may not be sufficient to recover these families from

drought as it negatively affects their investment plans and thus the impact obviously prevails for several years, unless the government has a proper mechanism to balance savings and investments.

Table 9: Investment plans based on the savings at the time before the drought

Scheduled investment plan	No. of households	% of total sample (N=540)
Buy the agricultural machineries	51	9.4
Building house	17	3.1
Buy a vehicle	9	1.7
Start a new business	7	1.3
Buy a land	7	1.3
Cover educational expenditure of children	7	1.3
For trade	2	0.4
For self-employment	1	0.2

Source: Field survey, 2015

Health cost of drought

Table 10 presents the number of patients due to drought or lack of drinking water. Four main diseases were identified: respiratory diseases (4.5%), cholera (0.1%), diarrhea (0.6%), and the kidney disease (6.8%). Kidney disease was the most widespread disease in the research area. Cholera and diarrhea patients were rarely reported.

Table 10. Number of patients due to drought or lack of safe drinking water

Disease	No. of patients	% of total sample
Respiratory diseases	24	4.5
Cholera	1	0.1
Diarrhea	3	0.6
Kidney disease	37	6.8

Source: Field survey, 2015

Table 11 depicts the costs of diseases including number of days spent suffering from disease, direct cost, and transport cost. Number of days at home or at hospital due to disease will be the same as the number of days absent at work. Spending more days at home or hospital may give less income. That loss with direct and indirect costs may create a heavy impact on the patient.

Table 11. Cost of diseases

		Number of days suffered from disease
Disease	Days (up to survey)	
Respiratory diseases	1,528*	
Cholera	12	
Diarrhea	17	
Kidney disease*	4,189*	
<i>Total</i>	5,746	
Charges of doctors and medications (direct cost)		
Disease	Charges (up to survey) Rs.	
Respiratory diseases	26,100	
Cholera	4,200	
Diarrhea	2,000	
Kidney disease	1021,500	
<i>Total</i>	1053,800	
Transport cost		
Disease	Cost (up to survey) Rs.	
Respiratory diseases	7,120	
Cholera	280	
Diarrhea	1,080	
Kidney disease	173,370	
<i>Total</i>	181,850	

Source: Field survey, 2015

Note: * though farm households indicate that respiratory diseases and kidney diseases are due to the drought, field observation noted drought 2013/14 do not adequately link with these diseases.

The kidney patients had the highest loss of working days, totaling up to 4,189 days. Kidney patients also have paid the highest charges for doctors and medications, amounting to Rs. 1,021,500. The total amount of doctors and medications charges (direct cost) was 1,053,800. Transport cost played a major role, which could be considered as an indirect cost. The total transport cost was Rs. 181,850, from which, kidney patients paid the highest proportion; i.e. Rs. 173,370.

Type coping mechanism adopted by farm households (and what they suggest) and strategies taken by the government to mitigate the adverse impact of drought

Table 12 shows the strategies adopted to minimize severity of drought in terms of agricultural production, consumption, and employment. A 6.1% of farmers have reduced cultivation, and thus, reduction of cultivation was a frequently adopted

strategy of farm households in drought periods. Stored food and paddy before the drought for future consumption was practiced by 1.3% of households and 1.5% of them had pumped tank water to the field. "Bethma" system, a traditional mechanism for equally distributing limited water to paddy fields was followed by 0.7% farmers and 0.2% of farmers had shifted towards growing vegetables. A 0.4% of farmers had constructed agro wells whereas 0.2% of households had reduced their daily consumption, as a strategy.

Table 12: Strategies adopted to minimize severity of drought in terms of agricultural production, consumption, and employment

Variable	Number of respondents	% of total sample (N=540)
Reduce cultivation	33	6.1
Store food and paddy	7	1.3
Pump tank water	8	1.5
<i>Bethma</i> system	4	0.7
Growing vegetables	1	0.2
Constructing agro-wells	2	0.4
Reduce daily consumption	1	0.2

Out of the total surveyed sample (N = 540), only 56 farmers have adopted strategies to minimize the severity of drought in terms of agricultural production, consumption, and employment. It reveals inadequate attention or awareness of farm households' strategies to minimize adverse impact of drought.

CONCLUDING REMARKS

This study attempted to assess economic impact of drought on farming communities with the intention of supporting appropriate policy guidelines to address drought related economic vulnerability among farming communities in Sri Lanka. Data for the study were drawn from a field survey conducted in the North Central Province (NCP) located in the dry zone of Sri Lanka in 2015.

As evident in most literature, the study found direct and indirect costs of drought to farming communities. The estimated agricultural income loss for rice per season, which was Rs. 30,710 per acre, revealed the magnitude of income loss of farm households, because the primary livelihood activity of these households is agriculture. Reduction in agricultural production coupled with productivity declines, and loss of cultivated area and increase in the price of agricultural commodities at the market during the drought period, has created food problems at the household level.

As a strategy to face the problem of food shortage, farm households had consumed less, borrowed foods, and reduced meal quantity. Withdrawal of savings from the banking system was also reported due to the worsened food security at the household level. The joint influence of production loss and food price increase during the drought have been identified as factors likely to reduce household demand for foods. According to Stiglitz (1976), a rising level of nutrient demand can increase the efficiency of labor, and hence, per capita income, such that income growth is constrained by nutrient availability. Thus, it can be assumed that production loss (supply shock) during a drought has multiplier effects —food price inflation and food security problem, and hence, nutrient problem at the farm households which slow down the growth at household level and regional economy.

Moreover, households had to use their savings to cover the educational expenditure of children, for emergency purposes, to minimize the impact of harvest loss, and to cover health costs, due to drought. The impact of drought on scheduled investment plans of households indicates that economic growth at household level slowdown for a few years because accumulated savings have been spent to cover the essential household needs.

Inadequacy of savings to cover direct cost of drought was evident from the borrowings of these households. They mainly relied on local money lenders for borrowings with additional conditions such as payback within a shorter period, higher interest rate, pay the interest first and settle the loan after, and higher value of instalment. Thus, a short-term relief mechanism may not sufficient enough to recover these families from drought because drought negatively affects their investment plans and thus the impact obviously prevails for several years if the government have no proper mechanism to balance savings and investments.

The study also discovered the activities taken to minimize drought severity by households such as reduced cultivation, use tank water, store paddy, practice *bethma* system (equal distribution), and reduce daily consumption.

This study concludes that drought has weakened the agriculture production, food consumption, investment capability of farm households, and increased the indirect costs to farm household such as health cost. Thus, immediate measures, particularly income mediating policies to provide compensation to drought affected families, are required to avoid likely multiple impacts of drought to farm households and the regional economy in the country.

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