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Impacts of Drought on the Market in the Northwest Region of Bangladesh: Availability, Diversity and Price

Md. Shafiqul Islam[1, *], Ummul Fatiha Binte-Shafiq[2]
[1]Department of Environmental Science, International University of Business Agriculture and Technology
[2]Department of Environmental Science and Engineering, Jatiya Kabi Kazi Nazrul Islam University

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Drought; market; availability, diversity; supply chain; price; consumer; households.

Abstract

A Market based study was conducted in the high (Tanore Upazila) and low (Natore Upazila) drought prone areas over the period of twelve months with the aims to know the impacts of drought on the market. Drought inhibits production, the inflow of agricultural produces and food supply in high drought market areas. Availability, diversity, price and sources of plant species become more restricted by the severe drought. The high drought market area shows less availability of the produces with low diversity and high prices. These attributes arrest consumer's behavior in food consumption patterns and restricted food supply in high drought market. Low drought market area shows normal production, regular inflows of agricultural produces. Mostly drought affects market in the Kharif-2 season. More local varieties were found in the low drought market during Rabi season. Appropriate drought forecasting in advance and drought insurance can protect production loss and ensure market supply.

1. Introduction

Drought is the uncertain innate disaster and it is not easy to predict. The Barind Tract is situated in the northwest region of Bangladesh. It is very much prone to drought due to geographical settings and climatology of the area. Average annual rainfall in the Barind Tract is 1000-1400mm. Drought is the most complex natural disaster and it is hard to predict and lessen the impacts of multiple factors. Two major factors such as lack of specific information and data on drought externalities or issues and difficulties are involved in defining the magnitude of drought. Islam and Roberts (2018) mentioned that severe to extreme droughts occurred in the Barind Tract of Bangladesh during the period 1976-2014. It has been caused the extreme climatic change in the past few decades and the world experienced severe droughts. Drought has severe impacts on the economy and society. According to Paul (1998), drought causes abnormal increase in prices as it damages agriculture, increases the unemployment and reduces food access capacity for rural people (small and landless labourers). Drought economic losses are occurred from livestock (dairy and beef), crops, timbers, and fishery production. BARC (2001) has reported drought prone areas in Bangladesh for three seasons including Rabi, Pre-Kharif and Kharif. Table I shows drought affected areas with different crop seasons.

Drought causes severe impacts on the market (availability, prices, diversity and consumption) arresting trade, accessibility and stability of food (Aghakouchak *et al.*, 2021). Drought decreased yields and limits the market supply increasing price of the produces, affecting domestic consumption and export (Ziolkowska, 2016). Like other disasters, droughts have no priority lists and little to no attention and its occurrences (Orimoloye, 2022). Even like other countries, drought is the great challenges in Bangladesh especially the study areas is how to deal with the drought and climate change impacts and how to build agriculture and food system climate resilient (*Rasul, 2021*). The most difficulty of forecasting and valid prediction of drought in relation to scale, magnitude and locations ahead of time, is a serious weakness (Khadr, 2016; Hao *et al.*, 2018; Kreibich *et al.*, 2019). Apart from market, drought is also distressing agricultural production and society. It was mentioned that the availability, diversity and price on the market influence by reducing production, water

*Corresponding author's E-mail address: dislam.env@iubat.edu
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recycle and species diversity *(Belle & Hlalele, 2015*). Two sides of coin (direct and indirect) effects of drought on economy have been identified (Cheng *et al*., 2011). Drought causes combined effects on production, market fluctuations and consumptions (Lin *et al*., 2013).

Table I: Drought prone areas in Bangladesh by cropping seasons

Drought category	Drought prone areas (Mha)		
	Rabi	*Pre-Kharif*	*Kharif*
Very Severe	0.446	0.403	0.344
Severe	1.71	1.15	0.74
Moderate	2.95	4.76	3.17
Slight	4.21	4.09	2.9
No Drought	3.17	2.09	0.68
Non-*T. Aman*			4.71
Total	12.486	12.493	12.544

Source: BARC, 2001

A study reported that drought impacts depend on producer behavior, Household behavior, Government behavior and trade type (Lin *et al.,* 2013). It is also reported that market price fluctuations of agricultural produces depend on drought scale and types. Greater diversity limit the economic risk and ecological loss at individual (farmer) level and on the global scale through making the systems sustainable and less susceptible to challenges (Swift *et al*., 2004; Baumgärtner & Quaas, 2010; Di Falco & Perrings, 2003). Drought does not affect only production at the households' level also on their purchasing capacity (Tschirley, 1998). Lin *et al*., (2013) reported that the market price of agricultural products rise around 3.59 percent during severe drought in North China. Now a day Drought is also main concern for global agricultural development. So called development is also responsible for food insecurity in the globe (Deng *et al.,* 2011; Liu and Yang, 2012). Drought disturbs on-farm diversity by reducing soil moisture, market diversity by limiting inflows (supply chain, diversity) and dietary diversity (low diet). It was mentioned that agro biodiversity is essentially important for sustainable development both for natural and anthropogenic as well as livelihood (Frison *et al.*, 2011; Thrupp, 2000). (Cleveland *et al*., 1992) reported that agro biodiversity support sustainable agriculture. Food and Agricultural Organization-FAO (1998 cited in Love & Spanner, 2007) estimated that there are 2, 50,000 to 5, 00,000 plant species in the world. According to Wilkes (1993), in agriculture only 1,500 plant species are being used. At present 120 important crops and three food crops such as wheat (Triticum spp.), rice (Oryza spp.) and maize (Zea mays L.) supply more than fifty percent food energy that consumed by humans (FAO, 1998). All these make together food insecurity and inferior dietary quality. Finally it creates huge impacts on nutrition, human health and livelihood strategies. Therefore, sustainable approaches to drought management are essential for implementing mitigation as well as adaptation to reduce drought impact on the market. The main focus of this study is to find out drought impacts on the market (availability, diversity, price fluctuations and consumption. The study aims to achieve following objectives are to:

- know the availability and sources of produces on the market in different seasons
- assess species (pulses, spices, vegetables, leafy vegetables, fish and animals) diversity in the market in relation to season between high and low drought prone areas.
- elicit the impacts and price fluctuations on the market due to production loss.

The following research questions have been administered for this study:

Research Questions:

- How drought impacts on species (plants and animals) at market level?
- How agro biodiversity loss impact on household consumption?

• What are the existing good practices available for the conservation of agro biodiversity to combat drought?

2. Methodology

The study has been conducted in the northwest region covering twelve months from July 2018 to June 2019. Two study locations were selected; one from high drought prone area (Tanore Upazila) of Barind Tract and another from low drought prone area (Natore Upazila) on the basis of CEGIS report (Khan and Islam, 2013) to compare the status of market diversity. The perception on the market (availability, diversity, price and seasonality) was assessed to know the people's view on drought impacts on the market. Total 300 respondents (50 respondents from small, 50 medium and 50 large farmers from each site) were interviewed on different aspects of the market (perception on availability, seasonality, diversity, prices and sources). The farm owners were also asked to know about the sources of food (farm, market, neighboring people, friends or relatives). Markets survey (2 markets from each area) was carried out considering diversity, price, availability and seasonality). Four Focus Group Discussion (two from each: one with elderly people and another with the ethnic people) were carried out to know the different aspects of market and cultural value of agro biodiversity. Semi-structured questionnaires were used in data collection. Both quantitative and qualitative data were utilized in this study. The market diversity was calculated using Shannon's Index and similarity/dissimilarity was calculated using Sorenson's coefficient.

1. The plant species diversity has been calculated using Shannon's diversity Index.

$$H = -\sum_{j=1}^{s} pi \ln pi$$

H= Shannon's diversity index

S= Total number of species in the community (richness)

p_i=The proportion of species *i* th relative to the total number of species (p_i)

$\ln pi$ =The natural logarithm of this proportion

2. $\text{Sorenson's Coefficient (CC)} = \frac{2c}{s1+s2}$

Where C is the number of species common in both sites, S1 is the total number of species in found in high drought area and S2 is the total number of species found in low drought prone areas.

The drought impact perception on market data were compared using rating percentage Index. The following formula used for this rating percentage:

3. $\text{RPI} = (\text{WP} \times 0.25) + (\text{OWP} \times 0.50)$

Where, RPI=Rating Percentage Index, WP=percentage of drought impact on market diversity acceptance and OWP= percentage of drought impacts on market diversity rejection, 0.25and 0.50 are constants. The lower value of RPI indicates the more the acceptance.

3. Results

3.1 The study area

Tanore Upazila (sub district) situated in the high drought prone area. The name Tanore came into existence in 1869 as Thana. There is a general belief that the Upazila might have derived its name from the mauza where its headquarters is located. The Upazila is occupying 295.40 square kilometers. It stands between 24°29' and 24°43' north latitudes and between 88°24' and 88°38' east longitudes. On the north it is surrounded by Niamatpur and Manda Upazilas, on the south by Paba and GodagariUpazilas, on the east by Manda Upazila and on the west by Nachole Upazila and Nawabganj sadar Upazilas (Fig. 1). The Upazila having total population191330 of which 94041 are males and 97289 are females (BBS, 2011). The sex ratio of the Upazila is 97. The population density is 648 person per sq. km. In the upazila, there are 47425 households and average household size for

the upazila is 4.03 persons. the literacy rate of the Upazila in 2011 was 48.8 percent for both sex, 51.1 percent for male and 46.7 percent for female. Main crops are paddy, wheat, jute, sugarcane, turmeric, oil seed, onion, garlic, potato, betel leaf and mulberry plant. Linseed, sesame, indigo, sweet potato, and *aus* paddy are on the way to extinction. Tanore experiences an average temperature of 38 degrees Celsius with very limited rainfall annually.

Natore Sadar Upazila covers an area of 401.29 square kilometers. It is situated in between 24°19' and 24°35' north latitudes and in between 88°51' and 89°07' east longitudes. It is surrounded by Atrai and BaghmaraUpazila on the north, Bagatipara and BaraigramUpazila on the south, Singra and GurudaspurUpazila on the east, Puthia and Baghmara Upazilas on the west (Figure 2). Total p*opulation* of the Upazila is 400030 of which 207466 male and 192564female. Indigenous communities including *oraon, santal* and *Buno* are living in this Upazila. Literacy rate 45.44 percent for both sex (male 49.91% and female 40.64%). The ma*in sources of income* are Agriculture 58.68 percent (BBS, 2011).The m*ain crops* are paddy, wheat, sugarcane, jute, ginger, turmeric and vegetables.

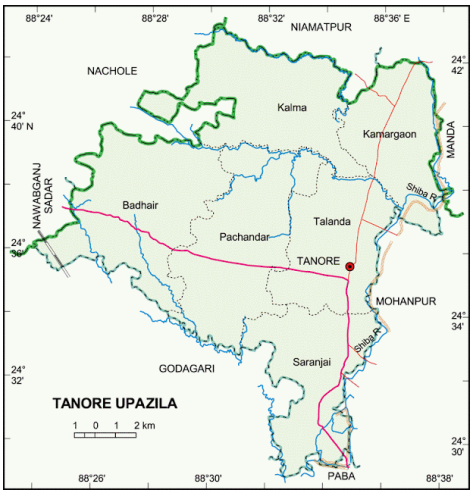

Figure 1: Study area High Drought Prone

Figure 2: Study area Low Drought Prone

3.2 Drought impacts on market

This section describes about the respondent's perception on the impacts of drought on the market in respect of food availability, diversity, seasonality and price of the produces.

3.2.1 Perception of drought impacts on market using Rating Percentage Index

According to household interviews, several drought impacts on market were mentioned by the respondents (Table II). The high price is the higher level perception of acceptance followed by less availability, less production and low variety in the high drought prone areas. On the other hand, less availability is the high level perception of acceptance followed by low variety, less production and high price in the low drought prone areas. Thus the result showed that there is a great impact of drought on the market. Drought causes severe impacts on market reducing crop yield production that influence agricultural sectors and community livelihood.

Crop failure is correlated with the economic impact of drought and other agricultural activities. Drought cause shocks in supply chain of the market during drought period and immediate after

drought crisis. The degree of economic loss depends on market structure including infrastructure, road communication, location, seasonality and scale of drought. There is a close link and interaction between supply and demand of produces with the market structures. It was mentioned by the respondents that farmers are not only the drought victims. The drought losses are not borne only by the farmers. A portion of the losses passed on to consumers due to increased prices, low production and irregular distribution. The increased prices charged extra on to consumers. It was argued by the respondents that higher economic shocks occurred in the high drought area market than low drought area market. They mentioned that drought affect from farm to plate by reducing yield and production, self-consumption, distribution, availability, high prices, economic losses, less quantity and diversity , less consumption and low nutrition for their health.

Table II: Perception of Drought Impacts on market using RPI

Drought Impacts on market	High Drought Area			Low Drought Area		
	Perception of acceptanc	Perception of rejection	Rating Percentage Index (RPI)	Perception of acceptance	Perception of rejection	Rating Percentage Index (RPI)
Less production	80	20	30	55	45	36.25
Low variety	65	35	33.75	60	40	35
Less availability	84	16	29	65	35	33.75
High price	88	12	28	50	50	37.5

Source: Field survey 2018-2019

It is very difficult task to estimate economic loss of farmers caused by drought throughout the market chain. Usually surplus local produces come to the local market to meet the demand of consumers. In drought crisis, there is a shortfall of local supply and drought attracts goods from distant markets to ensure supply flow into the local market, which helps smooth supply and fill the shortage and limits the price increase. The benefits of high prices are distributed to the outside producer of the drought stricken area due to high prices.

It was mentioned by the respondents from high drought area that they mostly depend on market then homestead and farm production and rarely from family& friends (Table III). Most of the respondents depend on the market. It was found that 85 percent respondents are met their spices demand through local/distant market followed by pulses (78%), fishes (70%), fruits (58%), vegetables (56%), animals (55%) and leafy vegetables (51%) respectively. The respondents and consumers from low drought area are less dependent on the market for their food. Eventually their homestead production is more due to less drought impacts on their production either at the homestead or at the farm. Abundance fishes were found in the low drought area during rainy season and only few fish species were found in the high drought area during the rainy season.

3.2.2 Market Diversity

According to market survey during Kharif-1 season, it was found that low drought area market showed higher market diversity (H=0.734; D=6.46) than high drought market area (H=0.708; D=6.197). It means that the higher the value the higher diversity (Table IV). The availability and price is normal in the low drought area market. High price and less availability is the main concern in the high drought area market.

Table III: Role of market in household food access and consumption

Food category	High Drought Area				Low Drought Area			
	Homestead & Farm	Market	Family friends	All	Homestead & farm	Market	Family friends	All
Vegetables	35	56	3	94	70	20	2	92
L vegetables	40	51	5	96	65	30	3	98
Pulses	20	78	0	98	70	20	0	90
Spices	15	85	0	100	25	70	0	95
Fishes	5	70	0	75	30	63	0	93
Animals	40	55	0	95	60	40	0	100
Fruits	17	58	2	77	35	48	1	84

Sources: Field survey 2018-2019

Table IV :Market Diversity in Kharif-1 season

Category	High Drought Prone Area					Low drought prone area				
	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)
Vegetables	15	0.268	0.072	-0.572	0.153	18	0.2278	0.0519	-0.642	0.146
Leafy vegetables	8	0.143	0.02	-0.845	0.121	11	0.1392	0.0194	-0.856	0.119
Pulses	4	0.071	0.005	-1.146	0.082	5	0.0633	0.004	-1.199	0.076
Fish	11	0.196	0.039	-0.707	0.139	18	0.2278	0.0519	-0.642	0.146
Animals	4	0.071	0.005	-1.146	0.082	8	0.1013	0.0103	-0.995	0.101
Spices	8	0.143	0.02	-0.845	0.121	9	0.1139	0.013	-0.943	0.107
	50	0.893	0.161		0.697	69		0.1505		0.696
Shanon's Index (H)					0.7083	Shanon's Index (H)				0.734
Diversity (D)					6.1976	Diversity (D)				6.6464*

Source: Market survey 2018-2019 (* indicates higher diversity)

Similarly, greater market diversity found in the low drought area market (H=0.734; D=11.046) and low market diversity in the high drought area market (H=0.708; D=8.92) in the *Kharif*-2 season (Table V). Result showed that the *Kharif*-2 season is mostly affected by the drought. The lowest market diversity was recorded in the high drought area market.

Again the result showed that the low drought area market showed greater market diversity than high drought area market during the Rabi season (Table VI). It was found that the diversity value of low drought area market (H=0.734; D=4.775) and high drought area market (H= 0.708; D=4.454). In respect of all seasons, it was observed that low drought area market shows greater market diversity than high drought area market (Table IV, V and VI).

Table V: Market Diversity in *Kharif*-2 season

Category	High Drought Prone Area					Low drought prone area				
	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)
Vegetables	14	0.25	0.063	-0.602	0.151	16	0.2025	0.041	-0.694	0.141
Leafy vegetables	4	0.071	0.005	-1.146	0.082	8	0.1013	0.0103	-0.995	0.101
Pulses	4	0.071	0.005	-1.146	0.082	6	0.0759	0.0058	-1.119	0.085
Fish	8	0.143	0.02	-0.845	0.121	9	0.1139	0.013	-0.943	0.107
Animals	3	0.054	0.003	-1.271	0.068	8	0.1013	0.0103	-0.995	0.101
Spices	7	0.125	0.016	-0.903	0.113	8	0.1013	0.0103	-0.995	0.101
	40	0.714	0.112		0.616	55		0.0905		0.635
Shanon's Index (H)					0.7083	Shanon's Index (H)				0.734
Diversity (D)					8.92	Diversity (D)				11.046*

Source: Market survey 2018-2019 (* indicates higher diversity)

Table VI: Market Diversity in Rabi season

Category	High Drought Prone Area					Low drought prone area				
	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)	Variety	Pi	Pi^2	lnPi	-(Pi*lnPi)
Vegetables	20	0.357	0.128	-0.447	0.16	26	0.329	0.1083	-0.483	0.159
Leafy vegetables	8	0.143	0.020	-0.845	0.121	12	0.152	0.0231	-0.818	0.124
Pulses	4	0.071	0.005	-1.146	0.082	6	0.076	0.0058	-1.119	0.085
Fish	12	0.214	0.046	-0.669	0.143	17	0.215	0.0463	-0.667	0.144
Animals	4	0.071	0.005	-1.146	0.082	9	0.114	0.013	-0.943	0.107
Spices	8	0.143	0.02	-0.845	0.121	9	0.114	0.013	-0.943	0.107
	56	1	0.224		0.708	79		0.2094		0.727
Shanon's Index (H)					0.7083	Shanon's Index (H)				0.734
Diversity (D)					4.4545	Diversity (D)				4.7751*

Source: Market survey 2018-2019 (* indicates higher diversity)

3.3 Factors influencing market diversity

Several factors are affecting market diversity. Respondents mentioned that drought affects market in many ways. At the farm, it affects production (low yield, low variety and high production cost), supply channels (distant places, transport cost and middlemen exploitation), market (low availability, low diversity, low purchasing capacity and stability) and consumption level (lack of awareness, low diet, and low diversity). Drought is the main influencing factor that affects market spiraling production, diminishing agro biodiversity, reducing consumption and diets and increasing price of

the agricultural produces and all are beyond the capacity of the households. From high drought area. 97 percent respondents mentioned that drought is a strong influencing factor for market followed by less production (83%) and own production (80%). Eventually 60 percent respondents mentioned that high price is another factor that reducing their purchasing power (Figure 3). On the other hand, 77 percent people from low drought area reported that low variety is responsible for market diversity followed by low production (73%), high price (60%), loss of agro biodiversity (57%), weather (53%), and drought (50%).

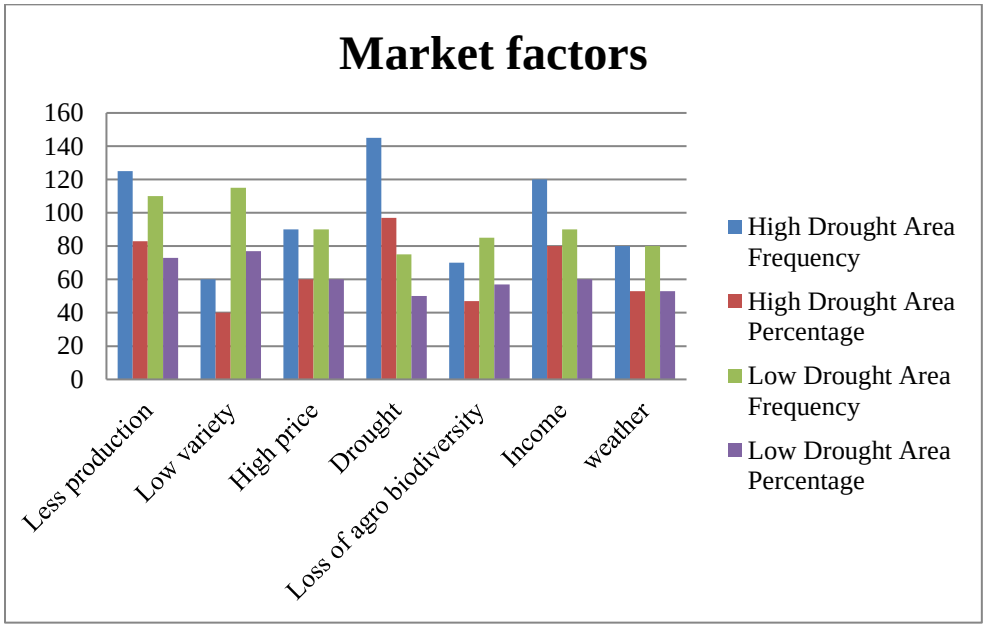

Figure 3: Market influencing factors

Respondents mentioned that drought affects market price and availability of the products. The participants from FGD mentioned that price differs from season to season and location to location with the stocks and supply of the produces. It was found that the price of the rice almost same in all market and it almost controlled by the auto rice mill owners of the country. The vegetables price differs from low drought market area to high drought market areas. It was recorded that the price around BDT 5 per kilogram or bundle is more in high drought market than low drought market (Table VI). The produces come to the high drought market from long distance (18-200 kilometers) during drought crises. Transportation cost and other cost (middle men exploitation, labour cost) enhance the price in the high drought market. It was mentioned that the produces come from Mohanpur, Uchadanga, Mundumala, Amnura, Poba, Jessore and Dinajpur (Table VII).

The respondents opined that the long distanceproduces is also known as chalany. In case of low drought market area most of the produces come from local production. Few produces come from short distance and it varies from 5 kilometers to 12 kilometers. More similarity was observed in spices followed by pulses, fish and animals in the *Kharif*- 1 season between high drought and low drought prone areas. Little bit dissimilarity was observed for vegetable and leafy vegetables. On the other hand, similarity was observed in spices followed by pulses, fish and animals during Rabi season in both areas (Table VIII). In respect of all season, more similarity was found in spices and

pulses. Respondents mentioned that drought affects vegetables and leafy vegetables in *Kharif*-1 and *Rabi* season.

Table VII: Price, sources and distance of few agricultural produces

Species	High Drought Area		Low Drought Area	
	(Price in BDT/ per Kilogram/bundle)	Sources and distance (Km)	(Price in BDT/ per Kilogram/ bundle)	Sources and distance (Km)
Bottle gourd (Lagenaria siceraria)	25 *(15-35)**	Moenpur ***(20)****,Amnura(25)	20 *(15-25)**	Local,Brahmapur ***(7)****
Sweet gourd (Cucurbita maxima)	20(15-25)	Chanlay(18),local	20(15-25)	Local,
***Potato* (Solanum tuberosum)**	20(15-25)	Local,Amnura(25)	20(15-25)	Local,Belghoria(12),
***Bitter gourd* (Momordica charantia)**	40(30-50)	Mundumala(28), Uchadanga(30)	35(30-40)	Local,Brahmapur (7)
Ribbed gourd (Luffa acutagula)	25(20-30)	Local, Uchadanga(30)	25(20-30)	Local, Belghoria(10)
Stem amaranth (Amaranthus viridus)	20(15-25)	local	20(15-25)	local
***Jute leaf* (Corchorus capsularies**	15(15-30)	Local, Uchadanga(30)	15(15-30)	local
Indian spinach (Basella alba)	15(15-30)	local	15(15-30)	local
Red amaranth (Amaranthus gangeticus)	20(15-25)	local	20(15-25)	local
Palwal (Trichosanthes dioica)	20(15-25)	Local,Poba(48)	20(15-25)	Local, Bogra(80)
Brinjal (Solanum melongena)	15(15-30)	Local, Amnura(25)	15(15-30)	Local, Brahmapur(7)
Elephant foot aroid (Amorphophallus campanulatus)	25(20-30)	Uchadanga(30), Moenpur(20)	25(20-30)	Local, Belghoria(12)
Local Paddy	40(30-50)	Local,	40(30-50)	local
Zira	40(40-42)	Local,Poba(48)	40(40-42)	
Noyonmoni	42(40-44)	Local,Mohonpur(43)	42(40-44)	
Atash	42(40-44)	Local, Poba(48)	45(40-50)	local
Pariza	45(40-50)	Local, Mohonpur(43)	45	local
Minicate	60(55-65)	Local,Dinajpur(190)	55(50-60)	Local, Dinajpur(200)

Source: Field survey 2018-19 (* indicates average price, ** minimum and maximum price, *** place and **** distance)

3.4 Species availability in the Market

3.4.1 Vegetables and leafy vegetables

39 vegetables and leafy vegetables including Cabbage (*Brassica oleracea* var *capitata)*, Cauliflower (*Brassica oleracea* var *botrytis)*, Radish (*Raphanus sativus)*, Pea(*Pisum sativum)*, Bottle gourd (*Lagenaria siceraria)*, Sweet gourd (*Cucurbita maxima)*, Wax gourd (*Benincasahispida)*, Cucumber (*Cucumis sativus)*, Ribbed gourd (*Luffa acutagula)*, Bitter gourd (*Momordica charantia)*, Palwal (*Trichosanthes dioica)*, Snake gourd (*Trichosanthesanguina)*, Potato (*Solanum tuberosum)*, Brinjal (*Solanum melongena)*, Tomato (*Lycopersicon esculentum)*,Chilli (*Capsicum* species), Okra (*Abelmoschus esculentus)*, Stem amaranth (*Amaranthus lividus)*, Red amaranth (*Amaranthus gangeticus)*, Indian spinach (*Basella alba)*, Spinach (*Spinacia oleracea)*, Goose foot (*Chenopodium album)*, Water spinach (*Ipomoea aquatic)*, Carrot (*Daucus carota)*, Sweet potato (*Ipomoea batatus)*, Eddoe (*Colocasia esculenta)*, Elephant foot aroid (*Amorphophallus campanulatus)*, Drumstick (*Moringa oleifera)*, Green papaya (*Carica papaya)*, Jute leaf (*Corchorus capsularies)*, Plantain (*Musa paradisiacal),turnip (Brassica rapa), Bean(Lablab niger), yambean (Pachyrrhizustuberrosa), squash (Cucurbita pepo), Corriandar (Coriandrum sativum*) *citrus (Citruslimon)*, pea leaf *(Pisum sativum)*, gram leaf *(Cicer arietinum)* were found in the study areas.

Table VIII: Similarity/Dissimilarity of the species in the market

Category	**Sorenson's coefficient**		
	Kharif-1 season	*Kharif*-2 season	Rabi season
Vegetables	0.60	0.73	0.60
Leafy vegetables	0.52	0.66	0.50
Pulses	0.88	0.80	0.80
Spices	0.94	0.94	0.94
Fish	0.68	0.70	0.75
Animals	0.66	0.68	0.71
All	0.68	0.78	0.69

Source: Field survey 2018-19

3.4.2 Pulses

Six pulses including Lentil (*Lens culinaris*), green gram (*Vigna radiata*), black gram (*Vigna mungo*),chick pea (*Cicer arietinum*), grass pea (*Lathyrus sativus*), and pea (*Pisum sativa*).

3.4.3 Spices

Nine spices including Onion (Allium cepa), Garlic (*Allium sativum*), Ginger (*Zingiber officinale*), Green Chili (*Capsicum annum*), Bay leaf (*Cinnamomum tamala*), Turmeric (*Curcuma longa*), black cumin (*Nigella sativa)*, Coriander (*Coriandrum sativum)*, Peppercorn (*Piper nigram*), Kababchini*(Piper cubeba*).

3.4.4 Fishes

Eighteen fish species Rui (*Labeorohita)*, Mrigel (*Cirrhinuscirrhosus)*, Katla (*Catlacatla*), Yellowtail catfish (*Pangasius pangasius*), Silver carp (*Hypophthalmichthys molitrix*), Bricate , Japanese, Bata (*Labeoariza)*, Swar Puti (*Puntius sarana)*, Telapiya (*Oreochromis mossambicus)*, Hybrid Magur (*Clarias batrachus)*, Shing (***Heteropneustes fossilis***), Koi (*Anabas testudineus)*,Wallago (*Wallago*

attu), Hilsha (*Tenualosailisha*), Tengra (*Gagatagagata*), Spotted snakehead (*Channa punctata*), chingri.

3.4.5 Animals

Nine animal species including Cow (*Bos taurus)*, Goat (*Capra aegagrus hircus)*, Vera (*Ovis aries)*, native Duck (*Anas platyrhynchos)*, Goose *(Anser anser)*, Hen (*Gallus domesticus)*, Dove (*Zenaida macroura), Pigeon(Columba livia) , Koyal (Eudynamisscolopaccus) were found in the low drought areas.*

4. Discussions

As opined by the respondents that drought rise price of the produces and they are not able to purchase their food from the market. Eventually the smallholders borrow money from the lender with high interest to buy food from the market. Similarly one study mentioned that the high prices give profit to peasants but this never supports the small holders and the borrower will be in debt and without food (Olsson, 1993). It was mentioned by the respondents that marketare driven by several factors including human capital, livelihood options, capacity to bear the risks, access to credit and consumer behavior. Zeller *et al.,* (1998) reported that market influenced by the farm size, production, capacity of risk management, credit constraint, human capitals and innovations. Horridge *et al.,* (2005) mentioned that drought worsening the balanced trade in Australia. Fish was not available in the high drought prone areas. The higher level of fish catch is found when water recedes after July in the both areas. Fishers continue to fish and harvest more during rainy period and before closing of the season. The scarcity of fish occurs during drought in the high drought area and December to April in the both areas. In case of livestock, people sell their cattle and poultry during drought crisis and cash as emergency arises (Gherson *et al*., 2012). In tackling drought crisis and managing market, advance drought prediction is essentially important to ensure food supply to the market. A study also suggested that accurate drought forecasting is required in advance, which are currently inadequate (Yaseen and Shahid, 2021). As per discussion with the respondents, there is urgent need of the drought insurance policy for the production and market stability. Similarly, several researchers pointed the importance of drought insurance that might bring positive impacts (Barnet *et al.,* 2008; Miranda and Farrin, 2012; Cole *et al.,* 2012; Jansen and Barrett, 2017).

5. Conclusion

Production, availability, access to market and purchasing power is very much important to combat drought effects. Access to loan or credit, improved market infrastructure, food aid and employment opportunity is essentially important in tackling drought crises. Usually the fallen agricultural production due to drought has been covered by the production of other parts of the country then food aid and other safety network programs. It was found that grain and vegetable price rise during severe and extreme drought. Agricultural products come from distant places and markets that increase the price of agricultural products in the drought market. This study indicates that drought causing impacts to the market especially supply chain, availability, diversity, price and purchasing capacity of the consumers. The *Kharif*-2 season is mostly affected as per opinion of the respondents. However the government initiatives, Climate smart agricultural production and consumer's behavior can ensure production at the farm level and regular flow of the produces in the market.

References

AghaKouchak, A., Mirchi, A., Madani, K., Di Baldassarre, G., Nazemi, A., Alborzi, A., ...& Wanders, N. (2021). Anthropogenic drought: Definition, challenges, andopportunities.

Bangladesh Bureau of Statistics (BBS). 2011. *Population & Housing Census 2011: Preliminary Results*. *July 2011*,Dhaka, Bangladesh: Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh

Bangladesh Agriculture Research Council (BARC). (2001). Impact of Land Degradation in Bangladesh: Changing Scenario in Agricultural Land Use, Karim, Z., and Iqbal, M.A. (Eds.), Soils Publication No: 42, BARC, Dhaka. 106p

Barnett, B. J., Barrett, C. B., & Skees, J. R. (2008). Poverty traps and index-based risk transfer products. *World Development*, *36*(10), 1766-1785.

Baumgärtner, S. and Quaas, M.F., 2010. Managing increasing environmental risks through agrobiodiversity and agrienvironmentalpolicies.*Agricultural economics*, *41*(5), pp.483-496.

BBS (**2001**).Bangladesh Population Census 2001, Bangladesh Bureau of Statistics; Cultural survey report of NatoreUpazila 2007.

Belle, J. A., &Hlalele, M. B. 2015. Vulnerability Assessment of Agricultural Drought Hazard: A Case of Koti-Se-Phola Community Council, ThabanaMorena, Mafeteng District in Lesotho. *J Geogr Nat Disast*, *5*(143), 2167-0587.

Cheng, L.H., Tang, H., Zhou, T.G., Zhang, M. and Zhang, L., 2011. Evaluation method of natural disaster intensity and its application: a research based on comprehensive disaster condition index. *Journal of Natural Disasters*, *20*(1), pp.46-50.

Cleveland, D.A., Soleri, D. and Smith, S.E., 1994. Do folk crop varieties have a role in sustainable agriculture? Incorporating folk varieties into the development of locally based agriculture may be the best approach. *BioScience*, *44*(11), pp.740-751.

Cole, S., Bastian, G., Vyas, S., Wendel, C., & Stein, D. (2012). The effectiveness of index-based micro-insurance in helping smallholders manage weather-related risks. *London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London*, *59*.

Di Falco, S. and Perrings, C., 2003.Crop genetic diversity, productivity and stability of agroecosystems.A theoretical and empirical investigation.*Scottish Journal of Political Economy*, *50*(2), pp.207-216.

FAO, 1998.*The state of the world's plant genetic resources for food and agriculture*.

Frison, E.A., Cherfas, J. and Hodgkin, T., 2011. Agricultural biodiversity is essential for a sustainable improvement in food and nutrition security. *Sustainability*, *3*(1), pp.238-253.

Hao, Z., Singh, V. P., and Xia, Y. (2018). Seasonal drought prediction: advances, challenges, and future prospects. *Rev. Geophys*. 56, 108–141. doi: 10.1002/2016RG000549

Hlalele, B.M., 2014. *Vulnerability assessment of agricultural drought hazard: a case of Koti-Se-Phola community council, ThabanaMorena, Mafeteng district in Lesotho* (Doctoral dissertation, University of the Free State).

Horridge, M., Madden, J. and Wittwer, G., 2005. The impact of the 2002–2003 drought on Australia. *Journal of Policy Modeling*, *27*(3), pp.285-308.

Islam, M.S. and Roberts, C., 2018. Exploring local drought and adaptation measures in the northwest region of Bangladesh.In*The Environmental Sustainable Development Goals in Bangladesh* (pp. 83-95).Routledge.

Jensen, N., & Barrett, C. (2017).Agricultural index insurance for development.*Applied Economic Perspectives and Policy*, *39*(2), 199-219.

Khadr, M. (2016). Forecasting of meteorological drought using Hidden Markov Model (case study: the upper Blue Nile river basin, Ethiopia). *Ain Shams Eng. J.* 7, 47–56. doi: 10.1016/j.asej.2015.11.005

Khan, M.F.A. and Islam, M.S., 2013.*Vulnerability to climate induced drought: Scenario and impacts*. CDMP.

Kreibich, H., Blauhut, V., Aerts, J. C., Bouwer, L. M., Van Lanen, H. A., Mejia, A., et al. (2019). How to improve attribution of changes in drought and flood impacts.*Hydrol. Sci. J.* 64, 1–18. doi: 10.1080/02626667.2018.1558367

Lin, Y., Deng, X. and Jin, Q., 2013.Economic effects of drought on agriculture in North China.*International Journal of Disaster Risk Science*, *4*(2), pp.59-67.

Liu, Y. and Yang, Y., 2012. Spatial distribution of major natural disasters of China in historical period.*ActaGeographicaSinica*, *67*(3), pp.291-300.

Love, B. and Spaner, D., 2007.Agrobiodiversity: Its value, measurement, and conservation in the context of sustainable agriculture. *Journal of Sustainable Agriculture*, *31*(2), pp.53-82.

Miranda, M. J., &Farrin, K. (2012).Index insurance for developing countries.*Applied Economic Perspectives and Policy*, *34*(3), 391-427.

Olsson, L., 1993. On the causes of famine: drought, desertification and market failure in the Sudan. *Ambio*, pp.395-403.

Orimoloye, I. R. (2022). Agricultural drought and its potential impacts: Enabling decision-support for food security in vulnerable regions. *Frontiers in Sustainable Food Systems*, *6*, 15.

Paul, B. K. (1998). Coping mechanisms practised by drought victims (1994/5) in North Bengal, Bangladesh. *Applied geography*, *18*(4), 355-373.

Rasul, G. (2021). Twin challenges of COVID-19 pandemic and climate change for agriculture and food security in South Asia. *Environmental Challenges*, *2*, 100027.

Swift, M.J., Izac, A.M. and Van Noordwijk, M., 2004. Biodiversity and ecosystem services in agricultural landscapes—are we asking the right questions?.*Agriculture, ecosystems & environment*, *104*(1), pp.113-134.

Thrupp, L.A., 2000. Linking agricultural biodiversity and food security: the valuable role of agrobiodiversity for sustainable agriculture.*International affairs*, *76*(2), pp.265-281.

Tschirley, D.L., 1998. *Planning for drought in Mozambique: Balancing the roles of food aid and food markets* (No. 1093-2016-87920).

Wilkes, G., 1993. Germplasm collections: their use, potential, social responsibility, and genetic vulnerability. *International Crop Science I*, pp.445-450

Yaseen, Z. M., and Shahid, S. (2021). Drought index prediction using data intelligent analytic models: a review. *Intelligent Data Analytics for Decision-Support Systems in Hazard Mitigation* 2021, 1–27. doi: 10.1007/978-981-15-5772-9_1

Zeller, M., Diagne, A. and Mataya, C., 1998. Market access by smallholder farmers in Malawi: Implications for technology adoption, agricultural productivity and crop income. *Agricultural Economics*, *19*(1-2), pp.219-229.

Ziolkowska, J. R. (2016). Socio-economic implications of drought in the agricultural sector and the state economy.*Economies*, *4*(3), 19.