Food security under a changing climate

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Abstract-As Per UNDP 2023 Report, humans are responsible for global heating over the last 200 years due to rapid industrialization, deforestation and fossil fuel combustion. This led to current temperature rise of 1.1°C above pre-industrial levels. Agriculture sector in India is vulnerable to global warning. Climate change has negative effects on irrigated crop yields across agro-ecological regions due to un-expected weather events, changes in precipitation patterns and reduces in water availability. It disrupt three dimension of food security i.e. food availability, access to food and utilization of food or food quality. Climate change affected demand and supply side of food supply chain which causes food In-security.

Objective of study is, to measure the food adequacy and malnutrition of household due to climate Change. We randomly collect the data from 11 anganwadi kendra of Bahanaga block, in Balasore district by using survey method and 10 percent of children's data collected from each anganwadi kendra which is total 119 children, where weight for age, height for age and weight for height will be recorded to achieve the objective. We used Anthropometric method as a statistical tool to do the analysis.

We calculated the Z score, match with WHO growth Standard and found that 18.5% children are moderate acute malnutrition, 15.12% are severe acute malnutrition, 61.34% are normal and 0.050% are overweight. Due temperature increase, crop yielding decreases and shortage for food results Malnutrition, this is inversely proportional to Food adequacy. So, Climate change creates impact on food security.

Key words: global warming, food availability, access to food, Food In-security, anthropometric method, survey method, Z score, malnutrition

INTRODUCTION

Rising temperatures and weather fluctuations may drive hunger and malnutrition, unless the country acts urgently. Climate change drives down yields. Last few years, we can see the rising temperatures and erratic rainfall have affected crop yields, and with the blistering heatwave across balasore district in March, April and May affecting the crops production. While farmers in Balasore usually get around 1 quintal [100 kilograms] of rice produce per 4 decimal of cultivated land, they got merely half quintal this year. Balasore is called the rice bowl of odisha. 95% of Farmer depends on Rice cultivation and family income is totally depends on specially rice production. If Rice production decreases then family income is affected and family spending also hampered? In Balasore district flood pattern in every year, Temperature rise and rainfall decreases, affected the crops production and some farmers are also unaware of Fasal Bima Yojana and some of them unable to pay annual premium. Many scientists argue that the impacts of climate change will be devastating for natural and human systems and poses an existential threat to human civilisation. Analysis of impact of climate change under National Innovations in Climate Resilient Agriculture (NICRA) found that climate change is expected to affect yields, particularly in crops like rice, wheat and maize. Climate change threatens not just the amount of food that Indian farmers can grow, but also its nutritional quality.

LITERATURE REVIEW

Ahmad, Jamil (2011) Topic Titled as "Impact of Climate Change on Agriculture and Food Security in India".This paper shows evidences on the climate change challenge; and assesses the impact of climate change on agriculture and food security in India. This paper also estimates the impact of climate change on Indian agriculture. Agriculture is the backbone of Indian economy. Directly or indirectly 55% of the country's population depends on the climate sensitive sector agriculture. The agricultural sector is a driving force in the gas emissions and land use effects that causes climate change.

Khyal Chand, Sumeet Thakur, Sandeep Kumar (2014) Topic Titled as "climate change and food security in india: contemporary concern and issues". The study revealed that climate change can adversely affect the all four dimensions of food security i.e. food availability, accessibility, utilization and stabilization. There is a great deal of uncertainty regarding climate change, but there are some certainties.

Diptimayee Mishra, Naresh Chandra Sahu, Dukhabandhu Sahoo (2015) Topic Titled as "Impact of climate change on agricultural production of Odisha (India): a Ricardian analysis". The study has adopted the Ricardian approach to assess the impact of climate change on the net revenue from agricultural production of Odisha. Panel regression model has been used to test the relationship between climate and other control variables on net revenue. Results of the study reveal that climate has significant influence on the agricultural production of Odisha.

Sunil Londhe (2018) Topic Titled as "Impact of Climate Change on Agriculture and Food Security". The article is an attempt to distil about the likely effects of climate change on food security and nutrition in coming decades. The consequences of climate change on various important aspects of agriculture are discussed and summarized. The article also discusses the analysis on the possible mitigation measures and adaptations for agriculture production in the future climate change scenarios.

Prabhu L. Pingali, Anaka Aiyar, Mathew Abraham (2019) Topic Titled as "Managing Climate Change Risks in Food Systems". It shows that climate change will decrease crop and livestock productivity in India. Climate change also impact health and labour productivity by increasing susceptibility to communicable and non-communicable diseases. Finally, we show that climate change will affect agricultural production and increase the vulnerability of poor regions and poor households, worsening inequities.

Ajay Kumar, Pritee Sharma (2022) Topic Titled as "Impact of Climate Variation on Agricultural Productivity and Food Security in Rural India". The study undertook state wise analysis based on secondary data for the duration of 1980 to 2009. Regression results for models proposed in this study show that for most of the food grain crops, non-food grain crops in quantity produced per unit of land and in terms of value of production climate variation cause negative impact. The state wise food security index was also generated in this study; and econometric model estimation reveals that the food security index itself also gets adversely affected due to climatic fluctuations.

OBJECTIVE

To measure the food security and malnutrition of household due to climate Change.

METHODOLOGY

Balasore district is the eastern coastal state of India. We randomly collect the primary data from 11 anganwadi kendra of Bahanaga block (21.3388° N, 86.7582° E) in Balasore district by using survey method and 10 percent of children's data collected from each anganwadi kendra which is total 119 children, where weight for age, height for age and weight for height will be recorded to achieve the objective. We used Anthropometric method as a statistical tool to do the analysis. It helps us to determine the malnutrition of children.

Primary data of crop production taken randomly from the household whose children's data collected in Anganwadi centre.

Meteorological Data collected from "balasore.nic.in" and "rainfall.nic.in".

Trend analysis of temperature and rainfall shows the crop production downing every year. It creates impact on household spending and due to spending decreases the food consumption also decreases. Malnutrition is based on food consumption. So, we interpreted that climate change directly influence on food security.

DATA INTERPRETATION

Simplified field tables

Weight-for-height BOYS
2 to 5 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
65.0	5.9	6.3	6.9	7.4	8.1	8.8	9.6
65.5	6.0	6.4	7.0	7.6	8.2	8.9	9.8
66.0	6.1	6.5	7.1	7.7	8.3	9.1	9.9
66.5	6.1	6.6	7.2	7.8	8.5	9.2	10.1
67.0	6.2	6.7	7.3	7.9	8.6	9.4	10.2
67.5	6.3	6.8	7.4	8.0	8.7	9.5	10.4
68.0	6.4	6.9	7.5	8.1	8.8	9.6	10.5
68.5	6.5	7.0	7.6	8.2	9.0	9.8	10.7
69.0	6.6	7.1	7.7	8.4	9.1	9.9	10.8
69.5	6.7	7.2	7.8	8.5	9.2	10.0	11.0
70.0	6.8	7.3	7.9	8.6	9.3	10.2	11.1
70.5	6.9	7.4	8.0	8.7	9.5	10.3	11.3
71.0	6.9	7.5	8.1	8.8	9.6	10.4	11.4
71.5	7.0	7.6	8.2	8.9	9.7	10.6	11.6
72.0	7.1	7.7	8.3	9.0	9.8	10.7	11.7
72.5	7.2	7.8	8.4	9.1	9.9	10.8	11.8
73.0	7.3	7.9	8.5	9.2	10.0	11.0	12.0
73.5	7.4	7.9	8.6	9.3	10.2	11.1	12.1
74.0	7.4	8.0	8.7	9.4	10.3	11.2	12.2
74.5	7.5	8.1	8.8	9.5	10.4	11.3	12.4
75.0	7.6	8.2	8.9	9.6	10.5	11.4	12.5
75.5	7.7	8.3	9.0	9.7	10.6	11.6	12.6
76.0	7.7	8.4	9.1	9.8	10.7	11.7	12.8
76.5	7.8	8.5	9.2	9.9	10.8	11.8	12.9
77.0	7.9	8.5	9.2	10.0	10.9	11.9	13.0
77.5	8.0	8.6	9.3	10.1	11.0	12.0	13.1
78.0	8.0	8.7	9.4	10.2	11.1	12.1	13.3
78.5	8.1	8.8	9.5	10.3	11.2	12.2	13.4
79.0	8.2	8.8	9.6	10.4	11.3	12.3	13.5
79.5	8.3	8.9	9.7	10.5	11.4	12.4	13.6

Weight-for-height GIRLS
2 to 5 years (z-scores)

World Health Organization

cm	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
65.0	5.6	6.1	6.6	7.2	7.9	8.7	9.7
65.5	5.7	6.2	6.7	7.4	8.1	8.9	9.8
66.0	5.8	6.3	6.8	7.5	8.2	9.0	10.0
66.5	5.8	6.4	6.9	7.6	8.3	9.1	10.1
67.0	5.9	6.4	7.0	7.7	8.4	9.3	10.2
67.5	6.0	6.5	7.1	7.8	8.5	9.4	10.4
68.0	6.1	6.6	7.2	7.9	8.7	9.5	10.5
68.5	6.2	6.7	7.3	8.0	8.8	9.7	10.7
69.0	6.3	6.8	7.4	8.1	8.9	9.8	10.8
69.5	6.3	6.9	7.5	8.2	9.0	9.9	10.9
70.0	6.4	7.0	7.6	8.3	9.1	10.0	11.1
70.5	6.5	7.1	7.7	8.4	9.2	10.1	11.2
71.0	6.6	7.1	7.8	8.5	9.3	10.3	11.3
71.5	6.7	7.2	7.9	8.6	9.4	10.4	11.5
72.0	6.7	7.3	8.0	8.7	9.5	10.5	11.6
72.5	6.8	7.4	8.1	8.8	9.7	10.6	11.7
73.0	6.9	7.5	8.1	8.9	9.8	10.7	11.8
73.5	7.0	7.6	8.2	9.0	9.9	10.8	12.0
74.0	7.0	7.6	8.3	9.1	10.0	11.0	12.1
74.5	7.1	7.7	8.4	9.2	10.1	11.1	12.2
75.0	7.2	7.8	8.5	9.3	10.2	11.2	12.3
75.5	7.2	7.9	8.6	9.4	10.3	11.3	12.5
76.0	7.3	8.0	8.7	9.5	10.4	11.4	12.6
76.5	7.4	8.0	8.7	9.6	10.5	11.5	12.7
77.0	7.5	8.1	8.8	9.6	10.6	11.6	12.8
77.5	7.5	8.2	8.9	9.7	10.7	11.7	12.9
78.0	7.6	8.3	9.0	9.8	10.8	11.8	13.1
78.5	7.7	8.4	9.1	9.9	10.9	12.0	13.2
79.0	7.8	8.4	9.2	10.0	11.0	12.1	13.3
79.5	7.8	8.5	9.3	10.1	11.1	12.2	13.4

Table 1 WHO chart (Weight for Height for Boys & Girls)

Table 1.1. (Children's Weight for Height)

Anthropometric Method						
Sl No.	Children Name	Sex (M/F)	Age (Year)	Wight (Kg)	Height (CM)	Weight for Height
1	Anish Ku Das	M	5	17.5	107	Normal
2	Alisha Das	F	5	16	106	Normal
3	Subhankara Barik	M	5	16.9	108	Normal
4	Jyoti Lipsa Das	F	5	16.8	105	Normal
5	Smaranika Das	F	5	15	105	Thinning
6	Dipteemayee Dutta	F	5	15.7	101	Normal
7	Subhalaxmi Pal	F	4.2	20.4	105	Over Weight
8	Arpita Das	F	4	11.8	103	Severe Acute Malnutrition
9	Ashribad Panda	M	4.8	16.3	107	Normal
10	Pratush Ku. Das	M	4.1	15.1	103	Normal
11	Alisha Behera	F	4.1	12.5	102	Severe Acute Malnutrition
12	Priti Priyadarsani Barik	F	4.3	14.9	106	Thinning
13	Sai Chandan Das	M	4	12.9	95	Thinning
14	Sandhyarani Malik	F	4.4	11.9	91	Normal
15	Anshumayee Das	F	4.3	12.1	94	Thinning
16	Nilambar Das	M	4.6	11	91	Thinning
17	Rashmita Barik	F	4.9	12.1	100	Severe Acute Malnutrition
18	Alipsa Mahalik	F	4.1	12	94	Thinning
19	Subhansi Dey	F	4	12	96	Thinning
20	Madhusmita Pal	F	4.2	12	92	Normal

21	Madhusmita Das	F	4.7	11.8	92	Thinning
22	Swayam Prabha Das	F	4.8	14.5	95	Normal
23	Bhumika Das	F	4.5	11.6	95	Severe Acute Malnutrition
24	Selina Malik	F	4.3	11.6	97	Severe Acute Malnutrition
25	Mrutunjaya Malik	M	4	16	98	Normal

We take 119 Anganwadi Children's data to satisfy our objective and Compare the data with WHO "weight for height" chart. We found Normal Children are 41.18%, Over Weight are 5.9%, Obesity are 2.53%, Severe acute malnutrition children are 28.6% and Thinning children are 21.9%.

Weight-for-age BOYS
Birth to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	2.1	2.5	2.9	3.3	3.9	4.4	5.0
0: 1	1	2.9	3.4	3.9	4.5	5.1	5.8	6.6
0: 2	2	3.8	4.3	4.9	5.6	6.3	7.1	8.0
0: 3	3	4.4	5.0	5.7	6.4	7.2	8.0	9.0
0: 4	4	4.9	5.6	6.2	7.0	7.8	8.7	9.7
0: 5	5	5.3	6.0	6.7	7.5	8.4	9.3	10.4
0: 6	6	5.7	6.4	7.1	7.9	8.8	9.8	10.9
0: 7	7	5.9	6.7	7.4	8.3	9.2	10.3	11.4
0: 8	8	6.2	6.9	7.7	8.6	9.6	10.7	11.9
0: 9	9	6.4	7.1	8.0	8.9	9.9	11.0	12.3
0:10	10	6.6	7.4	8.2	9.2	10.2	11.4	12.7
0:11	11	6.8	7.6	8.4	9.4	10.5	11.7	13.0
1: 0	12	6.9	7.7	8.6	9.6	10.8	12.0	13.3
1: 1	13	7.1	7.9	8.8	9.9	11.0	12.3	13.7
1: 2	14	7.2	8.1	9.0	10.1	11.3	12.6	14.0
1: 3	15	7.4	8.3	9.2	10.3	11.5	12.8	14.3
1: 4	16	7.5	8.4	9.4	10.5	11.7	13.1	14.6
1: 5	17	7.7	8.6	9.6	10.7	12.0	13.4	14.9
1: 6	18	7.8	8.8	9.8	10.9	12.2	13.7	15.3
1: 7	19	8.0	8.9	10.0	11.1	12.5	13.9	15.6
1: 8	20	8.1	9.1	10.1	11.3	12.7	14.2	15.9
1: 9	21	8.2	9.2	10.3	11.5	12.9	14.5	16.2
1:10	22	8.4	9.4	10.5	11.8	13.2	14.7	16.5
1:11	23	8.5	9.5	10.7	12.0	13.4	15.0	16.8
2: 0	24	8.6	9.7	10.8	12.2	13.6	15.3	17.1
2: 1	25	8.8	9.8	11.0	12.4	13.9	15.5	17.5
2: 2	26	8.9	10.0	11.2	12.5	14.1	15.8	17.8
2: 3	27	9.0	10.1	11.3	12.7	14.3	16.1	18.1
2: 4	28	9.1	10.2	11.5	12.9	14.5	16.3	18.4
2: 5	29	9.2	10.4	11.7	13.1	14.8	16.6	18.7

Weight-for-age GIRLS
Birth to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
0: 0	0	2.0	2.4	2.8	3.2	3.7	4.2	4.8
0: 1	1	2.7	3.2	3.6	4.2	4.8	5.5	6.2
0: 2	2	3.4	3.9	4.5	5.1	5.8	6.6	7.5
0: 3	3	4.0	4.5	5.2	5.8	6.6	7.5	8.5
0: 4	4	4.4	5.0	5.7	6.4	7.3	8.2	9.3
0: 5	5	4.8	5.4	6.1	6.9	7.8	8.8	10.0
0: 6	6	5.1	5.7	6.5	7.3	8.2	9.3	10.6
0: 7	7	5.3	6.0	6.8	7.6	8.6	9.8	11.1
0: 8	8	5.6	6.3	7.0	7.9	9.0	10.2	11.6
0: 9	9	5.8	6.5	7.3	8.2	9.3	10.5	12.0
0:10	10	5.9	6.7	7.5	8.5	9.6	10.9	12.4
0:11	11	6.1	6.9	7.7	8.7	9.9	11.2	12.8
1: 0	12	6.3	7.0	7.9	8.9	10.1	11.5	13.1
1: 1	13	6.4	7.2	8.1	9.2	10.4	11.8	13.5
1: 2	14	6.6	7.4	8.3	9.4	10.6	12.1	13.8
1: 3	15	6.7	7.6	8.5	9.6	10.9	12.4	14.1
1: 4	16	6.9	7.7	8.7	9.8	11.1	12.6	14.5
1: 5	17	7.0	7.9	8.9	10.0	11.4	12.9	14.8
1: 6	18	7.2	8.1	9.1	10.2	11.6	13.2	15.1
1: 7	19	7.3	8.2	9.2	10.4	11.8	13.5	15.4
1: 8	20	7.5	8.4	9.4	10.6	12.1	13.7	15.7
1: 9	21	7.6	8.6	9.6	10.9	12.3	14.0	16.0
1:10	22	7.8	8.7	9.8	11.1	12.5	14.3	16.4
1:11	23	7.9	8.9	10.0	11.3	12.8	14.6	16.7
2: 0	24	8.1	9.0	10.2	11.5	13.0	14.8	17.0
2: 1	25	8.2	9.2	10.3	11.7	13.3	15.1	17.3
2: 2	26	8.4	9.4	10.5	11.9	13.5	15.4	17.7
2: 3	27	8.5	9.5	10.7	12.1	13.7	15.7	18.0
2: 4	28	8.6	9.7	10.9	12.3	14.0	16.0	18.3
2: 5	29	8.8	9.8	11.1	12.5	14.2	16.2	18.7

Table 2 WHO chart (Weight for age of boys and girls)

Table 2.1 (Children's Weight for Age)

Anthropometric Method					
Sl No.	Children Name	Sex (M/F)	Age (Year)	Wight (Kg)	Weight for age
1	Anish Ku Das	M	5	17.5	Normal
2	Alisha Das	F	5	16	Normal
3	Subhankara Barik	M	5	16.9	Normal
4	Jyoti Lipsa Das	F	5	16.8	Normal
5	Smaranika Das	F	5	15	Normal
6	Dipteemayee Dutta	F	5	15.7	Normal
7	Subhalaxmi Pal	F	4.2	20.4	Over Weight
8	Arpita Das	F	4	11.8	Moderate Underweight

9	Ashribad Panda	M	4.8	16.3	Normal
10	Pratush Ku. Das	M	4.1	15.1	Normal
11	Alisha Behera	F	4.1	12.5	Moderate Underweight
12	Priti Priyadarsani Barik	F	4.3	14.9	Normal
13	Sai Chandan Das	M	4	12.9	Moderate Underweight
14	Sandhyarani Malik	F	4.4	11.9	Moderate Underweight
15	Anshumayee Das	F	4.3	12.1	Moderate Underweight
16	Nilambar Das	M	4.6	11	Severe Underweight
17	Rashmita Barik	F	4.9	12.1	Severe Underweight
18	Alipsa Mahalik	F	4.1	12	Moderate Underweight
19	Subhansi Dey	F	4	12	Moderate Underweight
20	Madhusmita Pal	F	4.2	12	Moderate Underweight
21	Madhusmita Das	F	4.7	11.8	Severe Underweight
22	Swayam Prabha Das	F	4.8	14.5	Normal
23	Bhumika Das	F	4.5	11.6	Severe Underweight
24	Selina Malik	F	4.3	11.6	Severe Underweight
25	Mrutunjaya Malik	M	4	16	Normal

We take 119 Anganwadi Children's data to satisfy our objective and Compare the data with WHO "weight for Age" chart. We found Normal Children are 46.21%, Moderate Underweight children are 23.52%, Severe Underweight children are 29.41% and Overweight Children are 0.84%.

Height-for-age BOYS
2 to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
2: 0	24	78.0	81.0	84.1	87.1	90.2	93.2	96.3
2: 1	25	78.6	81.7	84.9	88.0	91.1	94.2	97.3
2: 2	26	79.3	82.5	85.6	88.8	92.0	95.2	98.3
2: 3	27	79.9	83.1	86.4	89.6	92.9	96.1	99.3
2: 4	28	80.5	83.8	87.1	90.4	93.7	97.0	100.3
2: 5	29	81.1	84.5	87.8	91.2	94.5	97.9	101.2
2: 6	30	81.7	85.1	88.5	91.9	95.3	98.7	102.1
2: 7	31	82.3	85.7	89.2	92.7	96.1	99.6	103.0
2: 8	32	82.8	86.4	89.9	93.4	96.9	100.4	103.9
2: 9	33	83.4	86.9	90.5	94.1	97.6	101.2	104.8
2:10	34	83.9	87.5	91.1	94.8	98.4	102.0	105.6
2:11	35	84.4	88.1	91.8	95.4	99.1	102.7	106.4
3: 0	36	85.0	88.7	92.4	96.1	99.8	103.5	107.2
3: 1	37	85.5	89.2	93.0	96.7	100.5	104.2	108.0
3: 2	38	86.0	89.8	93.6	97.4	101.2	105.0	108.8
3: 3	39	86.5	90.3	94.2	98.0	101.8	105.7	109.5
3: 4	40	87.0	90.9	94.7	98.6	102.5	106.4	110.3
3: 5	41	87.5	91.4	95.3	99.2	103.2	107.1	111.0
3: 6	42	88.0	91.9	95.9	99.9	103.8	107.8	111.7
3: 7	43	88.4	92.4	96.4	100.4	104.5	108.5	112.5
3: 8	44	88.9	93.0	97.0	101.0	105.1	109.1	113.2
3: 9	45	89.4	93.5	97.5	101.6	105.7	109.8	113.9
3:10	46	89.8	94.0	98.1	102.2	106.3	110.4	114.6
3:11	47	90.3	94.4	98.6	102.8	106.9	111.1	115.2
4: 0	48	90.7	94.9	99.1	103.3	107.5	111.7	115.9
4: 1	49	91.2	95.4	99.7	103.9	108.1	112.4	116.6
4: 2	50	91.6	95.9	100.2	104.4	108.7	113.0	117.3
4: 3	51	92.1	96.4	100.7	105.0	109.3	113.6	117.9

Table 3.1. (Children's Height for Age)

Height-for-age GIRLS
2 to 5 years (z-scores)

World Health Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
2: 0	24	76.0	79.3	82.5	85.7	88.9	92.2	95.4
2: 1	25	76.8	80.0	83.3	86.6	89.9	93.1	96.4
2: 2	26	77.5	80.8	84.1	87.4	90.8	94.1	97.4
2: 3	27	78.1	81.5	84.9	88.3	91.7	95.0	98.4
2: 4	28	78.8	82.2	85.7	89.1	92.5	96.0	99.4
2: 5	29	79.5	82.9	86.4	89.9	93.4	96.9	100.3
2: 6	30	80.1	83.6	87.1	90.7	94.2	97.7	101.3
2: 7	31	80.7	84.3	87.9	91.4	95.0	98.6	102.2
2: 8	32	81.3	84.9	88.6	92.2	95.8	99.4	103.1
2: 9	33	81.9	85.6	89.3	92.9	96.6	100.3	103.9
2:10	34	82.5	86.2	89.9	93.6	97.4	101.1	104.8
2:11	35	83.1	86.8	90.6	94.4	98.1	101.9	105.6
3: 0	36	83.6	87.4	91.2	95.1	98.9	102.7	106.5
3: 1	37	84.2	88.0	91.9	95.7	99.6	103.4	107.3
3: 2	38	84.7	88.6	92.5	96.4	100.3	104.2	108.1
3: 3	39	85.3	89.2	93.1	97.1	101.0	105.0	108.9
3: 4	40	85.8	89.8	93.8	97.7	101.7	105.7	109.7
3: 5	41	86.3	90.4	94.4	98.4	102.4	106.4	110.5
3: 6	42	86.8	90.9	95.0	99.0	103.1	107.2	111.2
3: 7	43	87.4	91.5	95.6	99.7	103.8	107.9	112.0
3: 8	44	87.9	92.0	96.2	100.3	104.5	108.6	112.7
3: 9	45	88.4	92.5	96.7	100.9	105.1	109.3	113.5
3:10	46	88.9	93.1	97.3	101.5	105.8	110.0	114.2
3:11	47	89.3	93.6	97.9	102.1	106.4	110.7	114.9
4: 0	48	89.8	94.1	98.4	102.7	107.0	111.3	115.7
4: 1	49	90.3	94.6	99.0	103.3	107.7	112.0	116.4
4: 2	50	90.7	95.1	99.5	103.9	108.3	112.7	117.1
4: 3	51	91.2	95.6	100.1	104.5	108.9	113.3	117.7

Table 3 WHO chart (Height for age of boys and girls)

Anthropometric Method						
Sl No.	Children Name	Sex (M/F)	Age (Year)	Wight (Kg)	Height (CM)	Height for Age
1	Anish Ku Das	M	5	17.5	107	Normal
2	Alisha Das	F	5	16	106	Normal
3	Subhankara Barik	M	5	16.9	108	Normal
4	Jyoti Lipsa Das	F	5	16.8	105	Normal
5	Smaranika Das	F	5	15	105	Normal
6	Dipteemayee Dutta	F	5	15.7	101	Normal
7	Subhalaxmi Pal	F	4.2	20.4	105	Normal
8	Arpita Das	F	4	11.8	103	Normal
9	Ashribad Panda	M	4.8	16.3	107	Normal
10	Pratush Ku. Das	M	4.1	15.1	103	Normal
11	Alisha Behera	F	4.1	12.5	102	Normal
12	Priti Priyadarsani Barik	F	4.3	14.9	106	Normal
13	Sai Chandan Das	M	4	12.9	95	Normal
14	Sandhyarani Malik	F	4.4	11.9	91	Severe Stunting
15	Anshumayee Das	F	4.3	12.1	94	Severe Stunting
16	Nilambar Das	M	4.6	11	91	Severe Stunting
17	Rashmita Barik	F	4.9	12.1	100	Moderate stunting
18	Alipsa Mahalik	F	4.1	12	94	Moderate stunting
19	Subhansi Dey	F	4	12	96	Moderate stunting
20	Madhusmita Pal	F	4.2	12	92	Severe Stunting
21	Madhusmita Das	F	4.7	11.8	92	Severe Stunting
22	Swayam Prabha Das	F	4.8	14.5	95	Severe Stunting
23	Bhumika Das	F	4.5	11.6	95	Severe Stunting
24	Selina Malik	F	4.3	11.6	97	Moderate stunting
25	Mrutunjaya Malik	M	4	16	98	Normal

We take 119 Anganwadi Children's data to satisfy our objective and Compare the data with WHO "Height for Age" charts. We found Normal Children are 53.78%, Moderate stunting children are 15.12%, severe stunting children are 27.73%, Tall Children are 0.84% and tallest children are 2.52%.

We have taken the Temperature data of Balasore district of last 5 years i.e. 2018 to 2022.

Table 4. Temperature information of Balasore District

	Max Temperature (°C)				
	2018	2019	2020	2021	2022
Jan	31	29	29	31	30
Feb	32	31	31	33	33
Mar	35	36	35	42	39
Apr	37	37	38	40	40
May	37	38	36	36	41
Jun	39	37	37	37	38
Jul	35	37	37	37	37
Aug	33	35	36	36	36
Sep	35	35	35	35	35
Oct	34	34	34	34	35
Nov	33	32	33	33	34
Dec	29	30	31	32	33
Average Temperature	34.16667	34.25	34.33333	35.5	35.91667

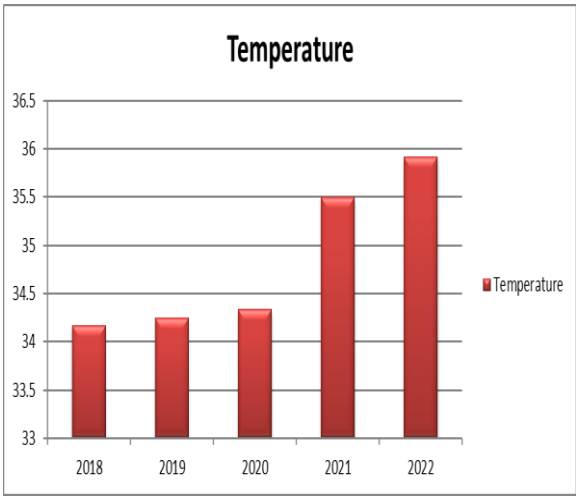


Figure 1 (Trend in Temperature from 2018 to 2022)

Figure 1 is showing the general increasing trend of temperature in the studied region

We have taken the rainfall data of Balasore district of last 5 years i.e. 2018 to 2022.

Table 5. Rainfall information of Balasore District

	Rainfall (mm)				
	2018	2019	2020	2021	2022
Jan	12	12	18	14	12
Feb	18	17	16	12	10
Mar	23	25	52	40	44
Apr	20	20	123	34	42
May	84	75	218	342	178
Jun	249	143	221	175	216
Jul	307	223	149	216	220
Aug	339	332	414	220	362
Sep	272	347	109	256	187
Oct	185	223	185	178	179
Nov	42	40	6	1	4
Dec	14	16	10	14	12
Average	1565	1473	1521	1502	1466

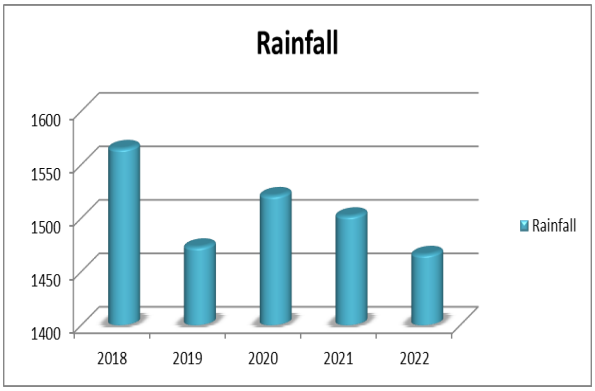


Figure 2 (Trend in rainfall from 2018 to 2022)

Bar chart 2 is showing the general decreasing trend of seasonal rainfall in the studied region.

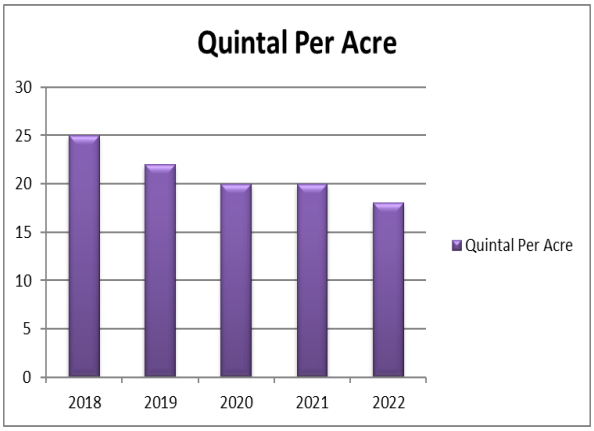
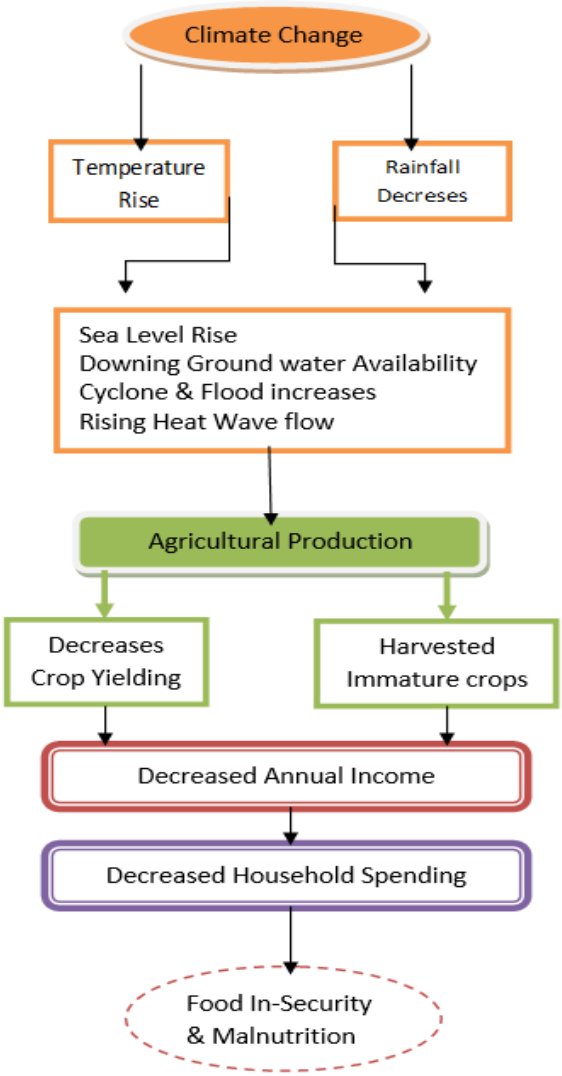


Figure 3 shows Crop Production trends from 2018 to 2022.

We found that the crop production of household decreases 28% from 2018 to 2022.

Findings



We found that 58.82 % children are under malnutrition of Weight for height measurement, 46.22 % children are under malnutrition of Height for Age measurement and 53.79 % children are under malnutrition of weight for age measurement.

Temperature analysis shows that, temperature increases 5.12% from 2018 to 2022 and Rainfall decreases 6.32% from 2018 to 2022.

CONCLUSION

Balasore District is susceptible to climate variability and change. Fluctuations or variations in climatic parameters are recurring phenomena in the studied districts. The effects of climate variability exacerbate existing social and economic encounters across the area, because people here are mainly reliant on

resources that are sensitive to climate variability and rain fed agriculture. Improved capacity to cope with future climate variability extremes can lessen the extent of economic, social and human loss. Rainfall and temperature are the most determinant climatic parameters in the area, as more than 80% of the agriculture is reliant on rain. The present study analyzed the meteorological data for the Balasore districts in Odisha. The variability analysis, the rainfall and maximum temperature are presented using bar chat. Temperature trend analysis shows that from 2018 to 2022 it is increasing 5.12 % and Rainfall decreases 6.32%. The production of crops also decreases, which was previously 25 quintal per acre and now it is 20 quintal per acre with using of maximum amount of inorganic fertilizer. Most of the household depends on farming and their household expenses directly proportional to their crop production. We also found that above 50% children from Bahanaga block are suffering from malnutrition.

From the analysis, it is clearly understood that climate change is impacting the food security of Bahanga block of Balasore district.

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