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SOCIO-ECONOMIC IMPACT OF CLIMATE CHANGE ON AGRICULTURE AND FOOD SECURITY: A STUDY OF HIMALAYAN STATES

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ABSTRACT

Climate change has adversely affected the two pillars-agriculture and food security, of the Indian economy. Great revolutions and policies have been implemented to boost primary sector, Green Revolution led agriculture to stabilize itself as self-sufficient thereby increasing its share of contribution to employment. Sustainable agriculture has ensured food security through various schemes like PDS to provide nutritious food to BPL families. However, climate change and unexpected natural calamities have affected agriculture, lowering the productivity and adversely affecting food security. The paper tries to show the correlation between the climate change and food security. This paper mainly discusses about the effect of climate change on agriculture sector, it also shows the dependency between PDS and food security. Since climate change has affected the country's topography in a major ratio but still there are people who live in such climate sensitive areas especially hilly areas and are totally dependent on them for their subsistence needs. Through this paper the researcher highlights the dependency of people on climate sensitive areas. Anthropogenic activities have created massive fluctuations in climate change. Crop failures due to climate change in many areas has hit the economy adversely and henceforth agricultural productivity has lowered down which is a serious matter of concern.

Keywords: Food Security, PDS, Climate Change, Agriculture

INTRODUCTION

Human Activities has always played a significant role in giving birth to major problems on the planet and one such problem is climate change.

Change is the law of nature, there are natural causes and some are anthropogenic changes. The

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population explosion has posed a threat to the resources, especially in the form of factors of production. It is a universal and pragmatic fact that human wants have an infinite intensity, which has led to over exploitation of resources and consequently it has adversely affected the climate to its core and made it vulnerable.

Climate change is a major apprehension, and most of the world is battling with the serious concern, because it has a multifarious effect. Socio-economic effects are how economic activity behaves and is reshaped by social and man- made processes. These even affect the natural cycle of climate which leads to the most hazardous activities like global warming, increment of greenhouse gases etc. which further has resulted in adversity. Recent studies and world events have also shown that, climate change is severe catastrophic issue now-a days since it is about to reach its peak level. Climate change is basically a change in the global or regional climate patterns due to man- made activities.

The issues of climate change has been consistently increasing since decades which now are on the verge of destructing our mother earth and now the time has come when these issues needs an immediate attention because it is not only affecting the social factors but also the economic status of every country globally.

Global warming caused by people is affecting even the daily lives but what are those critical aspects that are affecting earth and making it an increasingly warmer planet? If we talk about the first issue it is that 'The more heat released in the atmosphere melts the frozen bodies'. The frozen on the earth which is called as cryosphere in scientific terms melts and causes a warmer temperature this leading to climate change. This is resulting in shortage of fresh water, excessive flooding, extinction of animals, electricity shortage, disruption of weather patterns and the release of Methane gas which is trapped under glaciers and is toxic in nature. 'Conditions of weather are showing great fluctuations', which is also affecting many factors. Agriculture has been affected up to a larger extent because crops are not getting appropriate weather for their growths. The homes of plants and animals will be affected all over the world e.g. Polar bears.

'The hot weather has also shown its effect on oceans which have become more hotter and thus acidic by absorbing 90% of the heat and thus leading to the expansion of oceans' and further destructing the marine life. It is affecting the local economies since when fish are tainted and are in low supply due to a poor food web. Hence the fishermen across the world will be affected and tourism will also get halted thus leading to low growth of economies.

Scientists have shown a high confidence that global temperature will rise for decades to come, largely due to greenhouse gases produced by human activities and if they are not even controlled now then the outcomes will be disastrous and unexpected. The increase in temperature has led to

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many destructive activities. The data analysed by NOAA and NASA (2016) was recorded as the hottest year ever and there have been many natural disasters that occurred globally like Earthquakes in Japan, devastating floods in China, a fatal hurricane that swept across Haiti which had severe consequences to the mankind and posed a threat to the respective economies as well. However the latest case study i.e. 2018 Kerala flood which affected southern Indian state of Kerala due to unusually high rainfall and landslides during monsoon season has been the outcome of rapid climate changes as well as due to the discharge of excess water from 80 reservoirs across Kerala. This has affected people socially as well as economically. If we talk at social level thousands of people have lost their livelihoods, there has been a big population loss (463 people died and 15 went missing). Further if it is analysed on economic basis (19,500 crores estimated) have been spent on the victims of devastating flood to recover their losses. It is uncovered yet up to great extent. Not only the severe flood but also an immediate drought after it has created havoc in the state. This was exacerbated by the impact of climate change at macro level.

Climate change has affected agriculture and food security adversely. If India is the human body then agriculture is the spine and hence it is called the backbone of the nation's economy. As far as the contribution is concerned agriculture contributes 15-18% in the GDP every year. Agriculture not only contributes in terms of agricultural products but also generates employment for approximately 47% of labour force. Not only has this it also contributed in foreign exports by being the second largest producer of fruits and vegetables in the world. This sector is given an apt status by considering it as the backbone because it has also contributed in industrial sector by providing it the raw material for the production of various goods and services. (DUTTA & P, 2019) Currently the contribution of agricultural sector has decreased because the yield per year is decreasing due to the climate change and hence more and more labours have been unemployed now.

Due to the effect of climate change on agriculture the food security has also been affected tremendously. Food security is the state when all individuals have a reliable access to sufficient quantity of affordable and nutritious food to maintain a healthy and active life but this doesn't seems so in the current situation. Many countries across the world are facing the burden of hunger and malnutrition due to the less availability of food. The paper edifies the correlation between Public Distribution System and food security. Currently, 40% of the world's landmass is arid and hence the agricultural production has faced a great decrement. Population is increasing rapidly these days across the world and compared to which food availability is quite less due to which food availability has never been able to satisfy the population. Keeping this situation in context, the Malthusian theory proposed by Malthus explains the relationship between Population Growth and Food Supply. According to the theory the population grows in a

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sequence of geometric progression and on the other hand the food supply grows in arithmetic progression which brings out the conclusion that it happens due to Law of Diminishing Returns. The availability of food is less as compared to the population and hence according to Malthus – "People will die from shortage of food "which is exactly happening around the world.

The researcher tries to highlight the causes of climate change on the primary sector of the state and the direct as well as indirect repercussions of climate change on agriculture and allied sectors. Currently 5 lakh ration shops are functioning simultaneously across the country to provide accessibility to food for poor people. Various drawbacks in the functioning of PDS have been concluded. PDS lacks transparency, it has excluded many BPL families and included APL families due to which poor people are not able to afford the food. Poor quality of food grains as well as lack of infrastructure and shortage of funds across various states have also been highlighted. PDS needs a proper functioning across the country and so that it could benefit people across the globe. (Kavita, 2014)

PDS emerged as a system of managing scarcity of food and distribution of necessary food items on affordable prices. PDS was started with an initiative to feed the soldiers during World War- II but now it is the largest food distributing network in India. On one hand where PDS has worked efficiently up to some extent it also has various loopholes. Corruption which is a major problem of the country has overtaken even PDS also and various problems have been highlighted like people are not getting the basic food grains and items in proper quantity, overpricing has also emerged as big problem, moreover, poor people are also asked to pay bribes for very small food items. There is a lack of transparency and regularity in the working of PDS across villages in the country. Many solutions have been suggested like availability of food vouchers which reflects the idea that these food vouchers can be exchanged on any shop so that people can avail basic food items easily. Even the local administration can take the responsibility of collecting the food grains and supply them to each household to avoid the inaccessibility of food grains for the poorest of families in the country (Mohapatra & Mahalik, Sep. 2015)

Government has launched various schemes like mid-day meal scheme to provide free nutritious food to all the poor children but all the poor people are still not in the reach of government. Low purchasing power is held responsible for the low food security among poor people because they don't have money and hence cannot purchase food and feed their families. (Dev & Sharma, 2010)With this concern researchers suggest that more and more job opportunities should be developed for a better food security among the country and major focus should be laid on the climate sensitive and rural areas to enhance agricultural productivity to ensure food security. (Kumari & Kumari, 2015)

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The hilly areas of Uttarakhand are renowned for its natural settings and a great potential of providing livelihood but it's ironical to see that it provides a tough living to those residing here. It's not possible to set up any Industrial sectors in these area due to the structure of hills and climatic conditions and hence agriculture has served as a medium of their livelihood but due to the migration between urban and hilly areas it is being also affected largely. Specifically the BPL families living in these areas are not even able to earn two meals of the day for their families and PDS has failed to satisfy even the basic necessities of people in this region. There has been untimely distribution of seeds which is even less than the prescribed quota by government. The increased corruption by middlemen has also affected the quantity distributed by PDS. Hence more and more focus should be laid down on creating jobs for the people living in hilly areas. Land holdings should be increased and better irrigational facilities should be provided to them for a better livelihood and thus increasing food security by raising agricultural productivity. (KANDARI & BAHUGUNA, APRIL 2015)

Agriculture is the backbone on Indian economy which is totally a primary sector. It has huge importance in raising livelihood especially for people residing in rural areas. It is also a massive provider of raw material to the secondary sectors across the globe. Agriculture has flourished in post-independence period and has emerged as a significant contributor in the GDP of the nation. It has also provided many employment opportunities to the rural force and contributed in exports across the globe by being the largest producer of many eatables. The decline in the production in the past few years is a matter of concern. Hence agriculture has to be made sustainable to maintain the security of food across the country because of the dependency of people on it for their livelihoods. (HIMANI, (Feb. 2014),)

Climate change is one of the most important environmental challenges that effect the natural ecosystem of our surroundings. The paper mainly explain brief overview on the Socio- economic impacts of Climate change in context to Himalayan agriculture, Water resources, Forest ecosystem of Uttarakhand. Productivity of most of the crops is decreasing as Climate change is leading to increase in temperature as well as decrease in the availability of water for irrigation. It is estimated that when it comes to crops greater loss is seen in Rabi crops than Kharif crops. When the impact of climate change comes on rivers it may lead to became many rivers to be seasonal in future, which could have consequences on people livelihood followed by Economical and Ecological imbalance in the state. The greatest threats to Global Diversity is habitat destruction and climate change. The Vegetative bud break, fruiting, flowering and leaf drop which are considered as phenophase of plants was found to be influenced unfavourably due to change in variations of temperature and rainfall. (Parmar, Dhanai, Negi, & Singh, NOVEMBER 2014)

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Climate change is likely to have a massive threat to agriculture, food security and farmer's livelihood in the near future as the effects of climate change is clearly seen in present. The projections of climate change are reported generally at different spatial resolutions and due to current changes in climate inconsonance is not with the scale at which the agricultural development planning is done. The research highlights famer's perception on climate change with bifurcations of exposure, sensitivity, adaptive capacity and vulnerability. It was seen that the observations were done in respect to the onset and the withdrawal of monsoon, and the results were considerably clear as number of farmers either 'agreed' or 'strongly agreed' that due to change in climate the summer have become hotter and the onset of monsoon is getting delayed and withdrawal is earlier. (Ramarao,K Raju ,Rao, K V Rao, V U M Rao, Kausalya Ramacharan, k Nagasri, Ravi Dupdal, Josily Samuel, K Ravi Shankar, M Srinivasa Rao, M Maheshwari: 2018)

Due to climate change, disturb in local Eco-balance is being experienced especially in hilly states. There are severe impacts of climate change on the livelihood of Uttarakhand as most of the people livelihood and economic sectors are highly vulnerable to climate change. The weather conditions have become stormier and unpredictable than before. Extreme weather events are experienced such as receding glaciers with the increase in snowline, Erratic rainfall, Irregular rains in winter, fluctuations in flowering and budding behaviour of plants, Advancing cropping seasons, reduction in winter's snow. The changes are also experienced in the form of flash floods. (Mishra, 2014)

Mountains which are identified as repositories of biodiversity are also considered as the largest water providers of ecosystem goods to the downstream communities. But at the same time mountains are also known as most fragile environments ever existed. The evidence of the scientists have shown that the effect of global warming on mountains and down streams is irrevocable. And the instability caused in usual days spells are one of the impact held by climate change. The danger caused by climatic variability is a posing threat to the sustainability of allied sector in the phase of already decreasing natural resource base. The amount as well as duration of the rainfall have changed significantly. Climate change not only affected the cycle of floral and faunal behaviour but the changes in the animal behaviour is also observed. Massive impact of climate changes is perceived on agriculture, the pace of migration from the region has become faster. (Rautela & Karki, August, 2015)

The Economy of India is highly dependent on Agriculture. The Indian Agriculture is experiencing changes in climate which is leading to stagnation of net sown area, deterioration in soil's health, reduction in per capita land availability. The variation in climate is directly effecting the natural resources. Indian Agriculture vulnerability at the district level of Indo

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Gangetic plains is explained using three components:-

1) Sensitivity caused by climate change
2) Exposure to hazards
3) Adaptive capacity to recover

Agriculture is crucial as food, livelihood security is dependent upon it and the food bowl of India, Indo Gangetic plains are the ones getting most affected by the variation in climate caused by global warming (Singh, Arya, & Chaudhary, June 2013,)

Climate change, one of the key component that has affected agriculture adversely. Climate change has directly affected the primary sector as it lead to deterioration of productivity, rural place and adaptations. The study done on farmers showed that the majority of 95% farmers claimed that their farming activities are being affected by climate change, especially from past 10 years. Climate change has reduced their crop yield, and low rainfall has resulted to shortage of water and biomass for animals. Rise in frequent dry spells is observed with every passing year. There is a disproportionate burden bearded by the natural resources. The impact of climate change on Uttarakhand is clearly seen in the last past few years. The increased frequency of cloud bursts, extended rainfall, heavy snowing is observed. Increment in flash floods is also seen. (Raghuvanshi, Ansari, Amardeep, & Verma, November 2018)

This research focuses on the rapid climate changes which in result has affected the agricultural production of the country and in turn food security has also faced many changes. This research will help in analysing the various issues faced by farmers and the loopholes in the working of PDS system which will help the government to ensure better food security to the people and especially to the BPL families. This research will also help in generating Innovative ideas and technologies which can prevent agricultural sector from climatic changes and the growth of various crops will not be hindered.

PDS has played crucial role as a scheme of food security across the country. In a country like India where half of the population is undernourished, it has emerged as a boon. The origin of PDS during the war time with a motive to feed soldiers and their families expanded after the post-independence period and became a large linkage of thousands of FPS (Fair Price Shops) to feed every stomach across the country so that nobody dies of starvation and can have access to the nutritious food.

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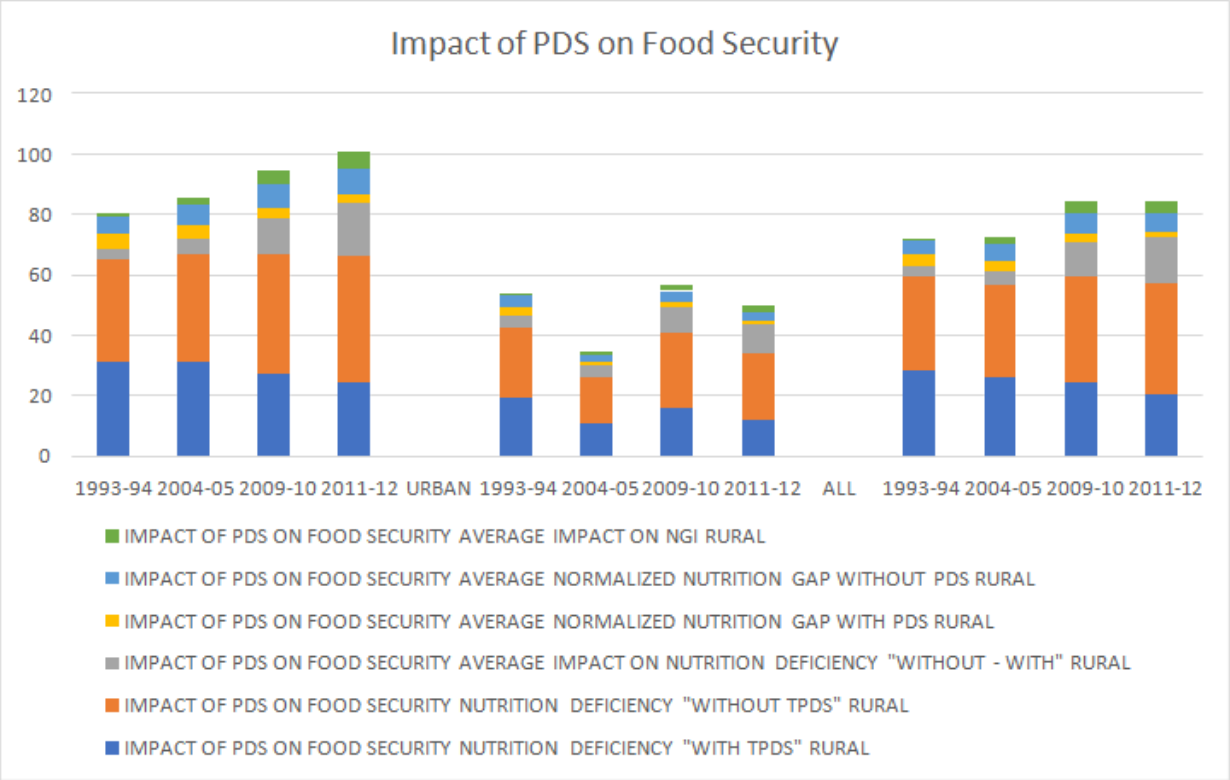

The above table shows the distribution of impact of PDS on food security on agriculture in the rural areas, urban and overall. As we can see that in the rural areas, the Indian food security system to distribute subsidized food and non-food items to the mass, has consequently increased, over a span of two decades. However we can also see in that the urban areas the results are undulated in the sense that there have been varied results over the twenty years. The data is post liberalization, privatization and globalization, and data suggests that even though the overall impact was not significant, but the impact in the rural areas was substantial.

Food security has always been a major concern of the nation. Food security is considered as the full availability and accessibility of food to every individual of the country but ironically in a country like India where one third of the population is poor and majority of the children are malnourished, food security seems to have no justification. In the post- independence period India has shown major growth in self-sufficiency in food items at macro level but its availability at micro level is still to be figured out. Although food management and maintaining the MSP has always been encouraged by government through PDS across the country and still many people cannot access to it. Buffer stocks has also been raised to help people during natural calamities and war time.

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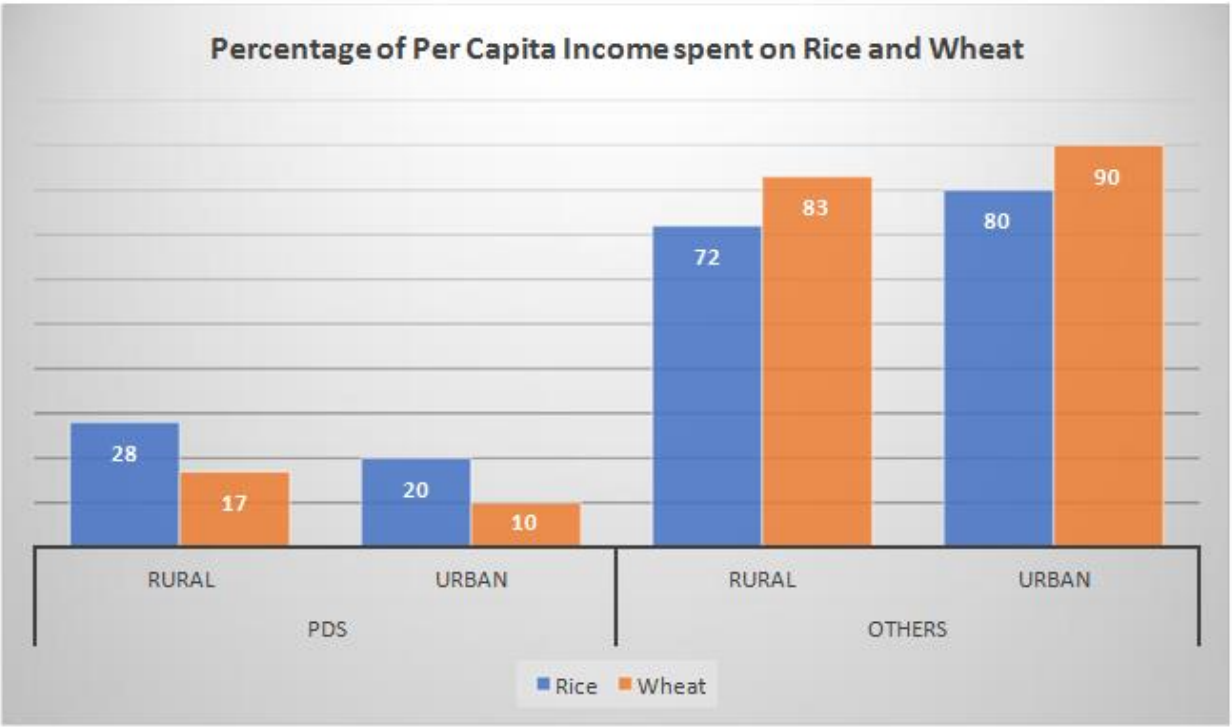
PDS is the largest food network of its kind in the world. It was launched at the time of Second World War and Bengal Famine to provide price support to producer and food subsidy to consumers. It has served as an effective measure to supply basic food items to the poor people especially to the BPL families. It has also served as an anti-inflationary measure along with that it has fulfilled the nutritious need of the people across the world. Being a very major scheme it has always been criticized by saying it as urban- biased with regard to which RPDS (Revamped Public Distribution System) has been launched.



The above graph shows the distribution of data depicting the percentage of per capita income expenditure on rice and wheat. The expenditure deciles show one way to seek solutions for major problems faced by agricultural sector. There is high consumption of rice in both rural as well as urban area. The NSSO (2014) data suggests that the expenditure on rice and wheat from PDS is extremely less as compared to other sources. The TPDS has focused on distributing rice and wheat however, the other research shows that there has been a change in the food preferences and has become more diversified. PDS should also be dynamic in its policies because this diversification in food items has been accompanied with high food inflation rates.

In 1997, government has launched TPDS (Targeted Public Distribution System) for the people lying Below Poverty Line and maintained a very low prices so that they can afford their basic necessities. PDS has contributed largely to initiate food security in India but on one hand where

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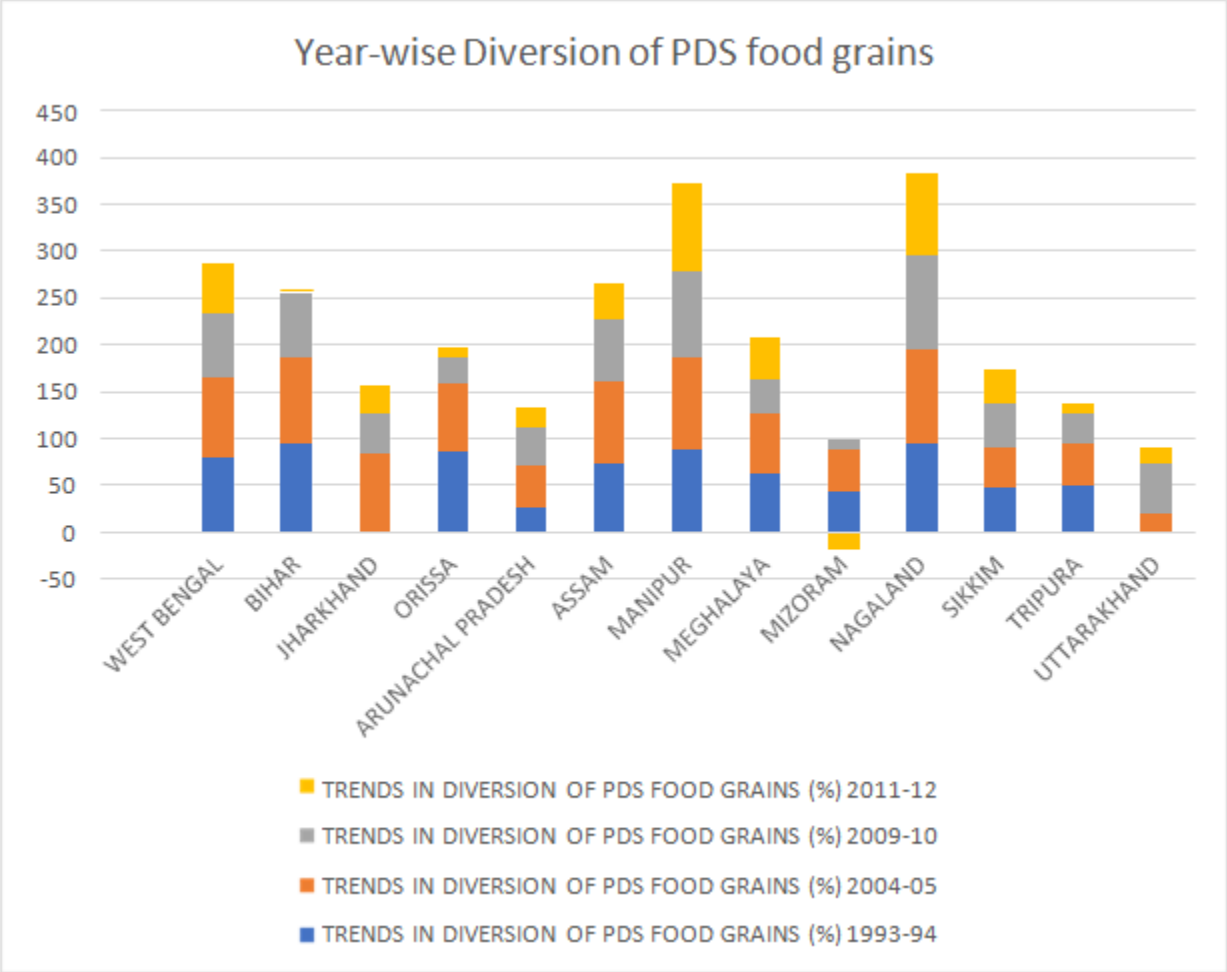
PDS has advantages, it has drawbacks too. Several drawbacks have been highlighted like Targeting error (where BPL families are targeted and corruption has been concluded as a major problem, moreover, many poor families do not have accessibility to ration cards). Other loopholes highlighted are diversions of food grains from PDS, Viability of FPS (Fair price Shops) and the cost of setting PDS is very high. Apart from this various measures have been taken to strengthen PDS system one such being UIDAI Aadhar scheme for the proper functioning of PDS to maximize its benefits and it's accuracy as well. (Hazarika, APRIL 2016)



Himalayan states are the most affected states with utmost severe dependency on natural factors, mostly due to erratic terrain. From 1993 to 2012 there has been a tremendous change in the pattern of the diversion of PDS. The PDS was very popular and subsequently successful in uplifting the Himalayan states in terms of food security. However with time and almost a decade later the popularity of the scheme has fallen substantially.

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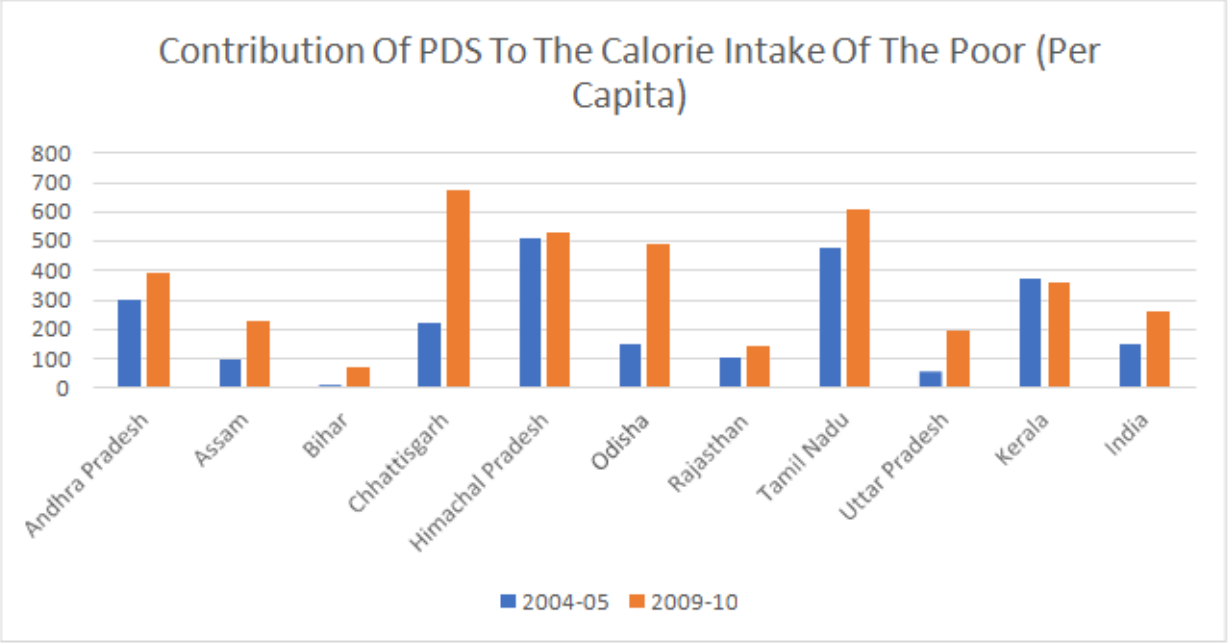
One of the most dominant phenomenon of nature is, climate. Which impacts all the spheres of environment. Uttarakhand is the one getting most affected by the variation in climate as Uttarakhand is the home to Himalayas. And change in climate is more pronounced in fragile mountains as it can jeopardize the ecological balance of existing natural environment. Climate change has very evident effects on the mountains, which are adversely affecting not only the natural system but to the economy as well. The changes in the mountains due to climate change are rapidly melting of glaciers. The loss in vegetation cover and snow cover is also observed. A huge loss in biodiversity with erratic weather patterns are recorded. A well-documented study gave the indications of higher rate of global warming in the Himalayas compared to the global average warming. (Pratap, 2013)



Rural India is much poorer than officially thought. The Planning Commission has made calorie intake policies on the basis of the recommendations of the Tendulkar committee, which estimates that more than 41 per cent of rural India is poor. In 2006, the Planning Commission declared the below the poverty line percentage, 28.3 per cent of India's rural population and 25.7 per cent of the urban population. The NSSO data shows that the PDS has been successful in many ways and states. Except in the state of Kerala where the contribution of PDS to calorie intake has declined within a span of 5 years. Most of the states especially the states where the per capita income is low and there is acute malnourishment, have been uplifted in terms of the nourishment and calorie intake.

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Food security is the backbone of any nation and its well-being. India is truly a developing country in terms of PCI, GDP, infrastructure etc. but the problem of managing food and distributing it accurately and appropriately has not been solved yet and hence the issue of food security arises. Existence of food security at micro level is a massive challenge for a country like India. Every night around 350 people go to bed without food. Food security is directly related to agriculture of a country and since agriculture has been affected drastically by drought, soil erosion, chemical fertilizers etc. which in turn reduces the food security. Not only agriculture but the problems like improper storage of food grains, food adulteration, and improper transportation facilities in the country have also been held responsible for poor food security in the country. Many recommendations has been made like increasing the storage facilities, reducing the number of middlemen between producer and consumers, increasing agricultural productivity and raising subsidies for farmers for the betterment of food security. India needs to be stable in terms of food security since it is one of the largest producer in the world and hence a major attention should be given to it.

CONCLUSION

Climate change is on its peak and it is destructing the agriculture and as a result the food security of the country is hindered. Human activities are creating a huge devastation to the mother earth and it's a matter of serious concern and hence it needs an immediate attention and henceforth we need to find an alternative to stop the effects of climate change on agriculture.

The effect of greenhouse gases should be reduced so that a country can adapt the climatic changes.

In a country like India, agriculture is the main occupation because more than half of the population depends on it for their survival which has faced the severe losses due to climate change. Many bumper crops have been destroyed with just a mere blink of an eye. Many farmers are committing suicides and many have even made suicidal attempts. Due to the decrement in the agricultural outputs many families are dying of starvation specially the BPL families. Not only this, but also the various loopholes in the working of PDS system has also decreased the efficiency and availability of essential and nutritional food grains for the poor people. Hence, more and more effective measures should be adopted for the efficient working of tackling the effect of climate change on agriculture as well as food security.

925 million people across the world are undernourished and it's heart-breaking to notice that a large percentage of people are Indians and much percentage of those who fall Below Poverty Line. Government keep on making implementations and policies to eradicate these issues and hence they have setup FPS (Fair Price Shops) across the countries so that every individual can

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have accessibility to the daily requirements of food but the PDS (Public Distribution System) is facing problems like lack of transparency since it is not in the reach of all the poor people. To overcome these issues government should try to decrease the number of people in supply chain of PDS so that it can work efficiently.

Climate change is affecting the agricultural sector and food security adversely and now the time has come when this needs a proper attention and government should made more implementations to control it. Some of the suggested measures are:

- Water regulation facilities should be provided in the arid regions across the country which is more likely to face droughts.
- Maximum subsidies should be given on fertilizers and seeds so that an ordinary farmer can afford them and yield a greater agricultural output.
- The main focus should be on increasing the quality of grains for a better yield.
- Measures should be taken to make agriculture and climate change compatible.
- Artificial atmosphere can be created for the proper growth of food grains.
- Measures should be adopted to reduce the impact of global warming on climate change.
- More and more implementations should be made to ensure food availability in remote areas to give them food security.
- Majority of people depend on agriculture for their livelihood and the people residing in climate sensitive areas are affected largely.
- There is severe dependency of economy and majority of people on climate sensitive areas.

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