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An analysis of the Impact of climate change on Kerala's agriculture with special reference to Palakkad District

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Abstract

Climate change and variability are concerns of human being. The recurrent droughts and floods threaten seriously the livelihood of billions of people who depend on land for most of their needs. The global economy is adversely being influenced very frequently due to extreme events such as droughts and floods, cold and heat waves, forest fires, landslips etc. The natural calamities like earthquakes, tsunamis and volcanic eruptions, though not related to weather disasters, may change chemical composition of the atmosphere. It will, in turn, lead to weather related disasters. In this study, the relation between agriculture and rainfall trends are analysed to identify and mitigate its adverse impacts.

Keywords – Rainfall , Climate variability , Climate change, Palakkad

Introduction

Agriculture is considered to be the backbone of Indian economy. With around 60% of the population dependent on this sector, it serves as the primary source of raw materials to strategic sectors like sugar, textiles and other industries. However, the contribution of this sector to the national output is just 17% which is not satisfactory. The economy of Kerala is no exception. It is a service led economy with illustrious success in the sectors of Education and health, and this peculiar development trajectory is praised as 'Kerala model of development', but the contribution of agriculture and industrial sectors are on a decline.

Climatic variations are not a new phenomenon. According to Intergovernmental Panel on Climate Change **(IPCC),** *Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.*

Review of Literature

Numerous studies had been carried out to analyze the impact of climatic variations on the production, productivity and area sown of food grains, pulses, cash crops in India and Kerala.*Singh et al(2019),*made a detailed analysis on the impact of climate variability on cash crops farming in India. The study employs C-D production function and found that cash crops farming in India is in an alarming position due to the unforeseen changes and instability in the climatic conditions. This paper throws light upon the policy recommendations such as implementation drip irrigation, organic farming and geography-based farming for mitigating the adverse effects of the same. *Deschenes et al,(2007)*made a cross sectional model and analyzed the economic impacts of climate change in US agriculture profits and found that predicted increases in the

temperature and precipitation has small or no effect on the profits of the US farmers. The climatic conditions are dynamic and it impacts the short run agriculture prices thereby affecting the common people.

The major finding of most of the studies conducted in different countries around the globe *[Otavio, J. F et al (1994), Rao, G. D(1994), Deschênes, O.(2007) Netardus, J. S. (2020), Djomo, (2020)]* is that the climatic variability adversely affect the agriculture variables causing distortions in the product market equilibrium and prices. However the intensity of such an impact varies according the development phase of the countries. *Kane et al (1992*) in their empirical investigation about the economic impacts of the climate change found that developing countries have to bear more costs than that of the developed countries in terms of trade, when climate variability affects the prices and surpluses of the producers and the consumers.

In an integrated assessment of the socio economic and climate change impact on agriculture *Fischer et al (2005)* analysed the Agro Ecological Zones (AEZ) and found that climate change is a long-term process and involves complex interactions between demographic, environmental, economic, political, institutional, social and technological processes. *Kumar and Parikh (2001)* shown for rice and wheat crop that projected large-scale changes in the climate would lead to significant reductions in their crop yields, which in turn would adversely affect agricultural production by 2060 and may affect the food security of more than one billion people in India.

The literature emphasizes the fact that the agriculture in India is extremely sensitive to climatic changes. Major crops of the country like Rice, wheat, barley, sorghum, arhar, and maize food grain crop get negatively affected by the climatic variations like temperature changes, rainfall etc. According to the policy recommendations of most of the empirical studies, Irrigation is the most important factor to mitigate the climate sensitivity impact of rice, wheat and many other food crops. *(Kar & Kar, 2008; Ranuzzi & Srivastava, 2012)*

Empirical results of the studies made by *Singh et al (2012), Kar & Kar (2008*) found that in the case of non-food crops, there is a negative and significant impact of the temperature variation in the production. There are some studies *Kumar, K. K., & Parikh, J. (2001), Netardus, J. S. (2020) Djomo, C. R. F et al(2020), Gokavi, N et al (2020)* which focuses on the relation between the farm net revenue and climatic variation found a negative relation. According to *Kumar, K. K., & Parikh, J. (2001),* a 2^0 C rise in temperature and a 7 percent increase in the precipitation will reduce the total net-revenue for India by about 8.4 percent. The study also estimated a 'U' shaped temperature response function which implied greater losses with higher temperature. *Saseendran et al (2000*) analyzed the projected results for 1980–2049 duration and found that increase in temperature up to 50°C can lead to a continuous decline in the rice yield and every one-degree increase of temperature will lead up to 6% decline in yield of rice in Kerala

Geography of Kerala

Kerala (38,863 km²; 1.18% of India's landmass) is situated between the Arabian Sea to the west and the Western Ghats to the east. Kerala's coast runs some 580 km in length, while the state itself varies between 35–120 km in width. Geographically, Kerala roughly divides into three climatically distinct regions. These include the eastern highlands (rugged and cool mountainous terrain), the central midlands (rolling hills), and the western lowlands (coastal plains). Located at the extreme southern tip of the Indian subcontinent, Kerala lies near the center of the Indian tectonic plate (the Indian Plate); as such most of the state (notwithstanding isolated regions) is subject to comparatively little seismic or volcanic activity.Geologically, preCambrian and Pleistocene formations comprise the bulk of Kerala's terrain. The topography consists of a hot and wet coastal plain gradually rising in elevation to the high hills and mountains of the Western Ghats. Kerala lies between north latitudes 8°.17'.30" N and 12°. 47'.40" N and east longitudes 74°.27'47" E and 77°.37'.12" E. Kerala's climate is mainly wet and maritime tropical, heavily influenced by the seasonal heavy rains brought up by the monsoon.

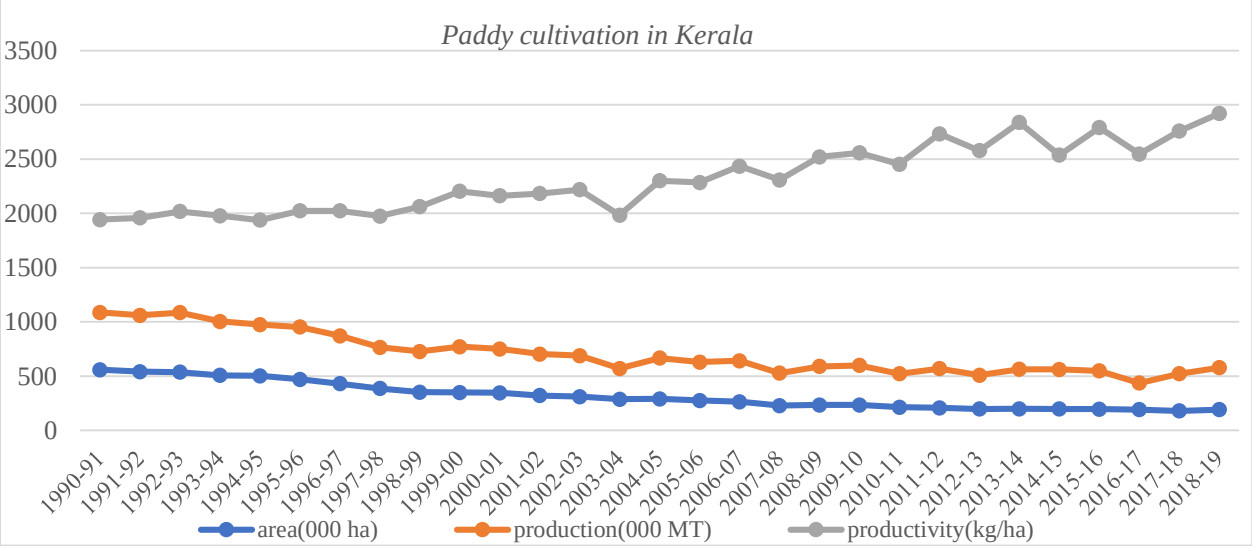
Climate in Kerala

Kerala, which lies in the tropic region, is mostly subject to the type of humid tropical wet climate experienced by most of Earth's rainforests. Meanwhile, its extreme eastern fringes experience a drier tropical wet and dry climate. Kerala receives an average annual rainfall of 3107 mm – some 7,030 crore of water. This compares to the all-India average is 1,197 mm. Parts of Kerala's lowlands may average only 1250 mm annually while the cool mountainous eastern highlands of Idukki district – comprising Kerala's wettest region – receive in excess of 5,000 mm of orographic precipitation (4,200 crore of which area available for human use) annually. Kerala's rains are mostly the result of seasonal monsoons. As a result, Kerala averages some 120–140 rainy days per year. In summer, most of Kerala is prone to gale-force winds, storm surges, and torrential downpours accompanying dangerous cyclones coming in off the Indian Ocean. Kerala's average maximum daily temperature is around 37 °C; the minimum is 19.8 °C.

Paddy cultivation-Trends in Palakkad and Kerala

The above literature shows that the climate variability is negatively impacting the agriculture around the globe. *However, studies concerning a statistical analysis of Kerala's agriculture sector are limited in number. With the onset of floods and high temperature from 2018 in Kerala, the growth of agriculture sector is at stake.* There are several factors which affect the agriculture production and productivity including fertilizers, hybrid seeds, advanced irrigation and so on. However, abnormalities in climatic conditions have multifaceted impacts from human health to food security of the nation

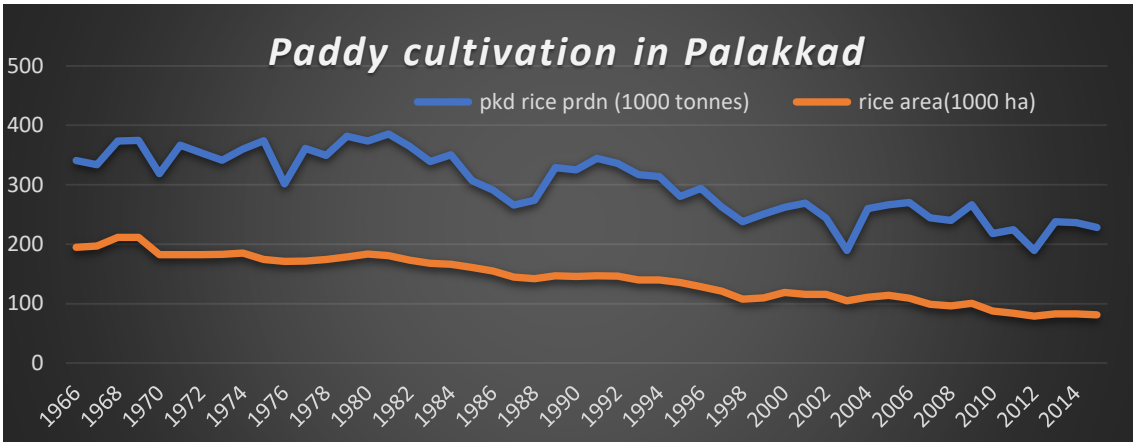
Figure 1- Area and production of Paddy cultivation in Kerala



Source:ICRISAT India

The graph clearly shows that there is a decline in the production of rice in Kerala. Also, the area under rice cultivation is more or less stagnant. However, the yield is showing an increasing trend, but it is highly fluctuating from year to year. There are many reasons for this trend. The primary reason is the increasing dependence on cash crops. The higher prices fetched by the cash crops is attaching more profits. Increasing material and labour costs along with poor organization of resources Increasing cost of living and inflation in the economy is again adding to the plight of the labourers. Uncertain Monsoon due to climatic variations is a major problem which is beyond the control of the humans.

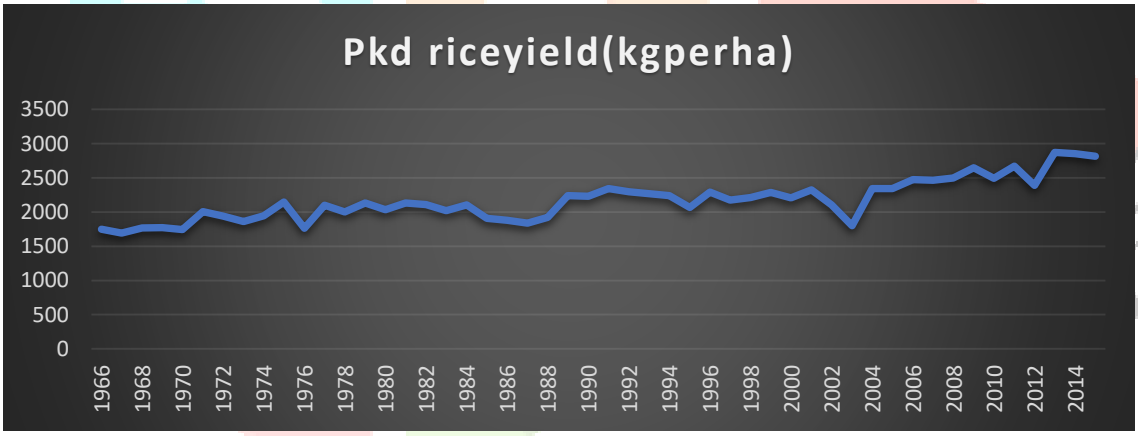
Figure 2 – Area and production Paddy cultivation in Palakkad



Source:ICRISAT India

The graph above shows the situation in paddy cultivation of Palakkad district in Kerala. Eventhough widely known as the granary of Kerala, we can see that the paddy cultivation has declined over the time. The rice production has showed the greatest decline in the year 2003.This year experienced a severe drought. Also the rice production in the district has experienced severe fluctutations also,which shows its unstable nature. The rice area also declined over this time period, however it is showing quite stable nature. This implies that people started to reduce their dependence on the farm activities

Fig 3 -Riceyield in Palakkad



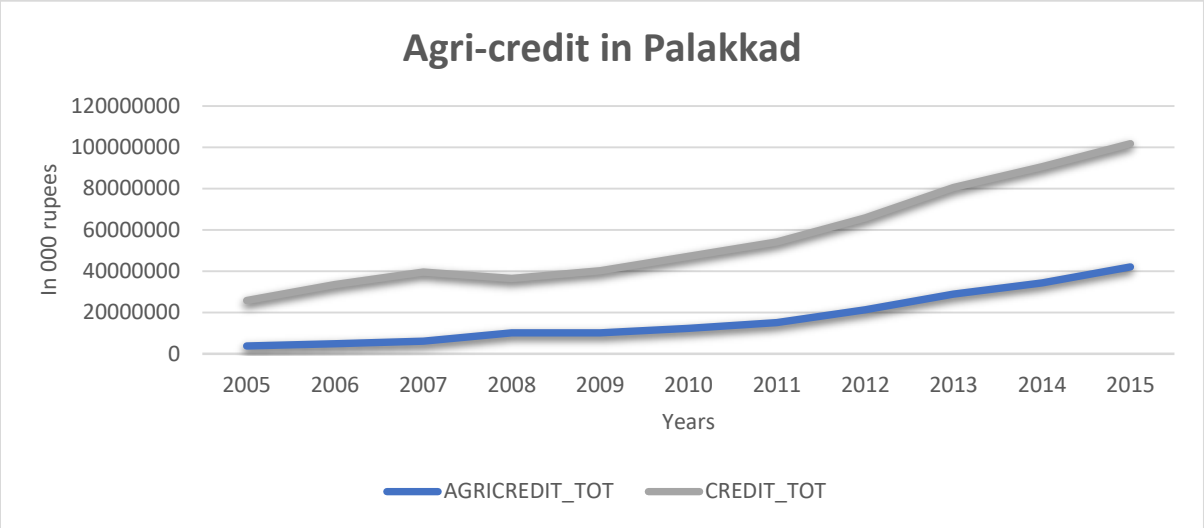
Source:ICRISAT India

This figure shows the yield from the rice cultivation. This shows an opposite trend as compared to the previous variables. This is a good sign as we can understand that the per hectare productivity of the rice is increasing. The greatest decline in the rice productivity is in the year 2003 as it is recorded as the year faced a severe drought. The increase in productivity can be attributed to the improved awareness of the farmers, better financial assistance from the government schemes etc.The input assistance given through sustainable rice development, operationalization of the paddy land and the wetland act 2008, registered seed growers programme /seed village programme etc improved the scenario of the rice cultivation in the district

Agricultural credit refers to one of several credit vehicles used to finance agricultural transactions such as a loan, note, bill of exchange, or a banker's acceptance. Financing is specially adapted to the specific financial needs of farmers. According to the RBI's recent report of the internal working group on agriculture credit, in some of the states, including Kerala the agri-credit is far higher than their agri-GDP, indicating the possibility of diversion of credit for non-agricultural purposes

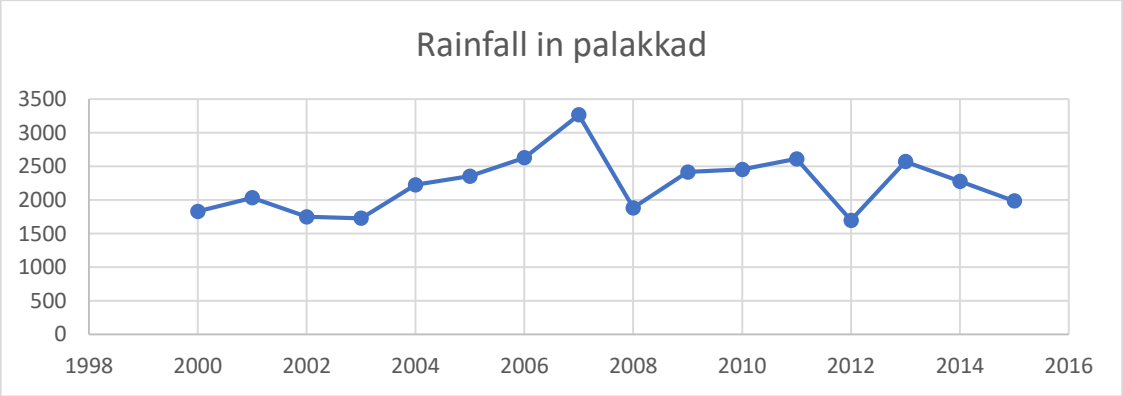
The agriculture department in Palakkad also focuses on the policies and programs relating to provision of credit to farmers. As we can see, there is a significant increase in the agriculture credit as a proportion of the total credit. The Studies have found that there is no significant relation between the agriculture credit and agriculture GDP growth

Figure 3 – Agriculture credit disbursal in Palakkad



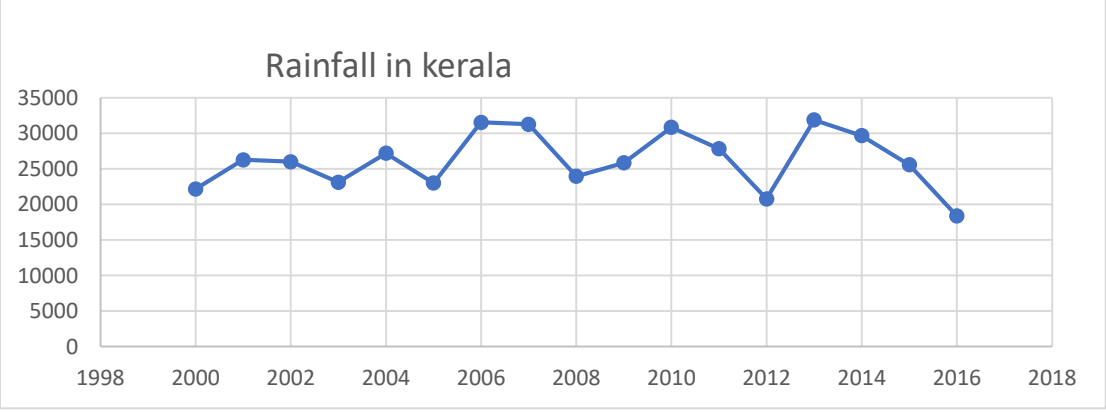
Source : Economic survey data

Figure 4 : Rainfall in Palakkad



(Source:IMD Data)

Figure 5 :Rainfall in Kerala



(Source:IMD Data)

Figures 5 and 6 gives an idea about the trends of rainfall in Palakkad and Kerala.In both these figures,we can see almost a fluctuating trend,highlighting the problem of climate change and variability.Both in kerala

and Palakkad the rainfall has been highest during the years 2007 and 2008.The fluctuations in rainfall is proving the need for proper farm plans and irrigation activities.

According to the data provided by Indian Meteriological Department(IMD),the mean temperature of Kerala has changed significantly. There has been a significant increasing trend in the mean temperature of Kerala and Palakkad from 1901-2015This adversely impacted the production of food crops. causing a threat to the food security of the state.Scientists blame **climate change** for this. Rise in sea surface **temperature**, due to global warming, drove up humidity

Conclusion

Scenes of flooding and storms show us just how much weather and climate can affect our lives.Understanding and predicting what the coming winter might bring, or predicting how climate will change over the next century is of vital importance - both for our economy and for society. The need and demand for accurate climate forecasts are increasing day by day. Analysing each climate sensitive sectors can help the nation to remain prepared at the wake of bad times.

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