Journal of Advances and Scholarly Researches in Allied Education
Vol. 16, Issue No. 2, February-2019, ISSN 2230-7540

A Case Study of Nalgonda Rainfall, Temperature and Climatic and Its Effect on Agricultural Productivity

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Abstract – Climates have changed before and will continue to change over later on. Alongside crustal development of the earth surface, climatic changes will undoubtedly be prove because of cumulative effect of earthbound and additional earthly forces. Eustatic and isostatic effects of such changes were dependably felt on the huge geo forms and along these lines on the land use frameworks. The biggest known financial effect of environmental change is upon horticulture as a result of the size and affectability of the area. Warming makes the best mischief horticulture in creating nations fundamentally in light of the fact that numerous homesteads in the low latitudes as of now suffer climates that are excessively hot. This paper audits several examinations that measure the span of the effect of warming on ranches in Nalgonga District in Telangana State. The most powerless segment to environmental change is horticulture and rural productivity would be significantly influenced by even a slight change in climatic condition. Horticulture is most vulnerable to climatic change when contrasted with different parts like water assets, timberlands and other the effect biological systems. The present examination has been attempted Nalgonda area to analyze the effect of changes in rainfall and temperature on the horticultural productivity at the mandal/region level in this locale of Telangana. The examination included factual assessment of rainfall, temperature and other meteorological parameters for a time of ten years.

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1. INTRODUCTION

Global worry about the antagonistic effects of changing atmosphere on horticultural productivity is raising (Adams et al., 1998). Simulation examination by utilizing distinctive models has appeared expanding CO2 fixation in the climate positively affects crop biomass creation, however its net effect on rice yield relies upon the rising of the temperature (Peng et al., 2004; Kim et al., 2003; Sheehy et al., 2006; Tao et al., 2008). In this way an assessment of the potential impacts of expanding CO2 levels and temperature on rice productivity is required. In Andhra Pradesh the temperatures are anticipated to increase by no less than 30 C all through the state because of environmental change amid 2041 to 2060 (Sreenivas and Raji Reddy, 2009). This increase may happen over the seasons of the year. This examination was under taken to survey the impact of environmental change on rice yield utilizing ORYZA 2000 model.

The changing climatic situation and its impact on different parts of the economy have risen as one of the best challenges before the researchers and arrangement producers everywhere throughout the world in twenty-first century. The impact of environmental change is relied upon to be distinctive in various pieces of the globe. A few regions and monetary frameworks may investigate positive impacts, though others may encounter misfortunes because of environmental change. Specialists are of the view that the impact of environmental change would be unassuming on the created nations and a large number of them are going to pick up from environmental change in future. In any case, there is a general agreement among the analysts on the fact that there would be huge decrease in horticultural productivity in creating nations because of environmental change. Ciscar et al. (2012) found that the impacts of environmental change would fluctuate generally among the regions, with the creating regions like Africa, Asia, Latin America and India specifically encountering the most negative effect of such change.

The vulnerability because of the negative impact of environmental change relies on introduction, affectability and the versatile limit of the region to environmental change. Scientists in this field trust that the regions which are arranged in tropical and sub-tropical climates are progressively presented to the antagonistic impact of environmental change. Further, the unfriendly effect of environmental change will fall heavily on

atmosphere touchy farming segment. Climatic factors go about as immediate contributions to horticultural creation alongside different sources of info, for example, land, water, manure, pesticides, and so on. Notwithstanding, the effects of climatic factors become increasingly articulated on farming in regions where, horticulture is in reverse or crude with less extension for innovative selection and transmission. The creating regions where poverty is a noteworthy concern and agribusiness is the real occupation alternative for the general population, estimating the impact of environmental change on farming in these regions is vital in perspective on attaining sustenance security and diminishing poverty.

The greenhouse gas which increases barometrical temperature has moved in overabundance in the earth in view of unreasonable misuse of petroleum products. It is as of now very evident that human exercises at different dimensions have been influenced unfavorably as a result of over the top grouping of barometrical carbon dioxide. Tree hugger, Social activists, Scientist are profoundly worried over the harms that are happening on horticulture, ranger service and different environments from intense climatic changes which thusly would influence trading arrangements both at the national and global dimensions as additionally asset use and sustenance security. Likewise if there is overwhelming rainfall the developing time of specific crops get unduly delayed, while considering the effect of environmental change on farming productivity all these clashing factors should likewise be taken in to thought? 90% of Indian horticultural productivity is subject to climate. The vast majority of the Indian states rely upon rainfall for irrigating the crops and this is applicable to the Nalgonda region too. As referenced before, the region's economy will be significantly influenced if there is a fall in rural productivity because of negative climatic changes. A move in the timings of rainfall additionally influences the cropping pattern of the region. These are the reasons why this investigation was attempted with the goal that the different meteorological parameters impact on rural productivity could be analyzed top to bottom and conceivable recommendations to changes in yield pattern could be made to increase rural productivity dependent on changes in climate conditions.

CLIMATE CHANGE AND AGRICULTURE

Environmental change and agribusiness are interrelated procedures, the two of which happen on a global scale. Environmental change influences horticulture in various ways, incorporating through changes in normal temperatures, rainfall, and atmosphere boundaries (e.g., heat waves); changes in vermin and sicknesses; changes in air carbon dioxide and ground-level ozone fixations; changes in the wholesome nature of certain sustenances; and changes in ocean level. Environmental change is now affecting agribusiness, with effects unevenly distributed over the world. Future environmental change will probably contrarily influence crop creation in low scope nations, while effects in northern latitudes might be sure or negative. Environmental change will most likely increase the danger of sustenance insecurity for some vulnerable gatherings, for example, poor people. Agribusiness contributes to environmental change by:

- Anthropogenic emissions of ozone depleting substances (GHGs), and
- By the change of non-agrarian land (e.g., woodlands) into rural land. Farming, ranger service and land-use change contributed around 20 to 25% to global yearly emissions in 2010.

There are a range of policies that can decrease the danger of negative environmental change impacts on farming, and to lessen GHG emissions from the agribusiness division.

2. LITERATURE REVIEW

Sadly, writing relating to the effects of climate change on horticulture in Bangladesh is meager and strongly qualitative. Various papers on Bangladesh's risk, vulnerability and adjustments to climate change (Ali, 1999; Agrawala et al, 2003; Huq et al, 2004; Brouwer et al, 2007) have been strategy centered and have needed quantitative techniques to separate the impact of climate change on agrarian productivity from other bewildering factors.

Agrawala et al (2003) utilized an emotional ranking framework to identify key vulnerabilities Bangladesh faces from climate change dependent on circulation models and past studies1 of the nation. The creators assessed agribusiness as having a medium "sureness of impact" risk, low medium "timing of impact" risk, low-medium "seriousness of impact" risk and high "importance of asset" risk dependent on the examinations recognized on Bangladeshi farming and their general assessment of the other risk zones. Curiously, horticulture positioned last behind water assets, coastal assets and human wellbeing. Agrawala et al limited the impact of climate change on agribusiness since a portion of the conceivable gainful and adverse effects of climate change on crop yield may balance one another: A higher recurrence of extraordinary, possibly crop harming climate occasions could be counterbalanced by higher crop yields with unassumingly hotter temperatures. The effects of climate change are characteristically region explicit, inciting the requirement for region-put together research with respect to climate change.

Explicitly examining Bangladesh, Rashid and Islam (2007) recognized dry seasons, floods, saltiness and twisters as the significant extraordinary climatic occasions to which Bangladeshi farming is generally vulnerable. Furthermore, they recognized a progression of structural adjustments important to mitigate potential impacts of climate change on horticulture, including: crop expansion far from those most vulnerable to climatic changes; improving water proficiency; improving crop creation techniques; putting resources into measures to mitigate the impact of violent winds and other natural debacles; recovering soil saltiness by putting resources into cultivating Boro rice and sweet water shrimp; and putting resources into hardware to speed up cultivating tasks. Past investigations dependent on scientific models in Bangladesh have utilized the CERES2 - Rice and DSSAT3 models (Karim et al, 1996; Mahmood, 1998; Mahmood et al, 2004; Basak et al, 2010) to evaluate climate change influence on farming. These models mimicked the effects of rising temperature and CO2 focus on rice. Karim et al (1996) directed a progression of simulations utilizing the CERES-Rice and - Wheat models for Aus, Aman and Boro rice, and wheat. They tried the affectability of the crops to three unique dimensions of environmental carbon dioxide fixation (330, 580, and 660 sections for every million) and two dimensions of temperature increases (2 and 4 degrees Celsius). They found that while higher centralizations of CO2 increased yields with temperature unchanged, higher temperatures adversely influenced yields even with higher CO2 focuses.

Basak et al (2010) inferred that climate change was probably going to have predominately adverse impacts on the yield of Boro rice. They found that if climate change was to result in increased temperatures, this would cause grain sterility amid the developing season and thus a diminished yield. They likewise discovered that while changes to the dimension of barometrical carbon dioxide and sun oriented radiation may balance the impact of increased temperatures somewhat, that it would not be adequate to mitigate it inside and out.

Mahmood et al (2004) saw that since downpour bolstered rice establishes over half of all out rice generation in Bangladesh, creation of this crop is amazingly vulnerable to instability in the supply of water. Early rainstorm landing can cause flood harm to rice seedlings in early development stages, while late storm entry can prompt water pressure. Their use of the CERES-Rice model found that high water pressure could prompt yield misfortunes as high as 70% to rice plants in both flowering and developing stages, proposing possibly lamentable impacts for rice creation from changes to seasonal storm event brought about by climate change.

Sarker et al (2012) performed time arrangement investigation to evaluate this inquiry for three noteworthy rice crops (Aus, Aman and Boro) in Bangladesh at the total dimension utilizing both Ordinary Least Squares and middle quantile relapse. Notwithstanding, this examination did not represent regional varieties and in secret heterogeneity. The creators utilize most extreme and least temperature and rainfall as climate factors and found a significant connection between climate change and agrarian productivity. They found that base temperature was significant just for the Aman and Boro assortments, with a negative impact on yield in the previous case and a positive impact in the last mentioned. Greatest temperature was observed to be significant for all assortments, with a positive impact on yield of Aus and Aman and a negative impact on Boro yield. At long last rainfall was observed to be significant just for Aus and Aman, with a positive impact on yield for the two assortments.

Harpreet Kaur (2017) – Climate change is a basic issue with regards to the Indian economy. The nation's geological dynamics and the nearness of abnormal state of poor and sustenance unreliable populace add to its vulnerability to climate change. India is home to about 24.5 percent of the undernourished individuals on the planet. Increased event of temperature limits, increase in the quantity of warm days and evenings, adjusted rainfall patterns, increased recurrence of shortfall rainstorm and substantial precipitation occasions have been seen in the nation. Further, these patterns are anticipated to continue. In this specific situation, the investigation talks about the climate change patterns and their impact on agribusiness and nourishment security in the nation. The experimental examination utilizing Ordinary Least Squares (OLS) and Instrumental Variables ((IV) relapses demonstrates that climate particularly temperatures adversely impact both farming and nourishment security. The importance of advancement of suitable procedures to address rural productivity particularly upgraded water system offices, framework and appropriation of direct interventionist measures tending to sustenance insecurity in the nation is underlined by the exploration article.

3. OBJECTIVE

1. To Study the impact of climate on rural productivity.

2. To Study the impact of climate on GDP of Region

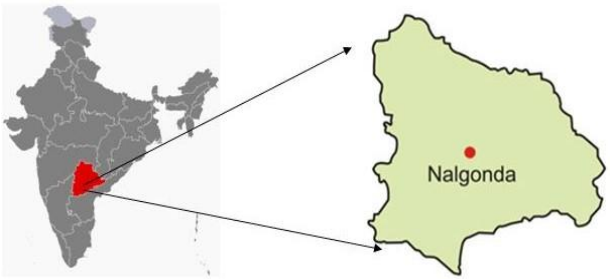
3. To analyze the impact of changes in rainfall and temperature on the rural productivity at the mandal/area level in this locale of Telangana

4. RESEARCH METHODOLOGY

4.1 Study Area

Nalgonda area is a locale in the Telangana province of India. It has a populace of 3,483,648 of which 13.32% is urban as of 2011.The region is spread over a region of 2,449.79 square kilometers (945.87 sq mi). Starting at 2011 Census of India, the region has a populace of 1,631,399 Nalgonda region is the fourth biggest region of Telangana. It is situated between 160 25' and 170 50' N of scope, 780 40' and 800 05'E of longitude. The region covers a zone of 14'240 sq.kms. The primary crops that are developed in this region are paddy, jowar, ground nut and chillies. The two agro – climatic zones incorporated into Nalgonda area are the southern Telangana zone and the Northern Telangana Zone.

The Krishna River, Musi River, Aleru, Peddavagu, Dindi River, Halia River and Paleru course through the Nalgonda area. The area is tremendously influenced by high fluorine content in water.



The locale is isolated into three income divisions of Nalgonda, Miryalaguda, and Devarakonda. These are sub-isolated into 31 mandals and have 565 towns.

4.2 Sources of data collection

The Secondary technique information was utilized in this investigation is to analyze the different meteorological parameters and its effect on horticultural productivity at the mandal and locale dimension of Nalgonda area.

4.2 Period of the study

The investigation is directed for a long time an examination of the horticultural, financial and meteorological information is completed.

4.3 Statistical tools used in this study

Calculation of measurable identified with the normal month to month, seasonal and yearly rainfall is finished utilizing the SPSS and Microsoft Excel 2007 programming for each mandal of the area. So as to distinguish any persistence in the rainfall arrangement a straight relapse test was finished.

5. RESULTS AND DISCUSSIONS

There are two region zones into which the Nalgonda locale can be partitioned. The northern Telangana zone involves the chose four mandals. This region has an annual rainfall between 900 to 1000 mm. The other zone is the Southern Telangana zone which has the annual rainfall between 600 to 800 mm. The two meteorological parameters of rainfall and temperature are utilized for examination of all the 59 mandals of the locale. To the extent temperature and rainfall is concerned information was gathered for a period starting 2006 to 2016. No significant change in temperature was seen in the region and the maximum and minimum temperatures stayed steady. Concentrates completed before in the region have demonstrated a region connection among temperature and agrarian productivity. By simply 20c increase in temperature, the rice yield in different pieces of India decreases by about 0.75 ton/hectare in the yielding zones (Agricultural Census Profile 2011). While the Rabi cropping is in progress in numerous pieces of North India the temperature increases by around 10 c. Also, some particular regions demonstrate a bigger climatic variety with a bigger impact on Rabi crop creation. In Kerala for a one degree ascend in temperature the rice yield falls by about 6%. Every one of these facts unmistakably show that reviews identified with temperature variety is essential to become acquainted with about rural productivity of crops in a given region (Agricultural Journal of India 2014). In this examination an investigation was done on the locale level rainfall information accumulated between the periods 2006 to 2016. The rate distinction between the annual and typical rainfall in the Nalgonda area ranges from - 43.7 to 22.2%.

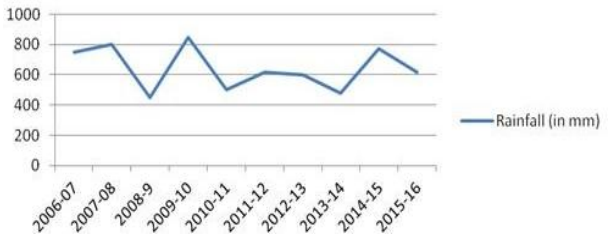


Figure 1 Year wise annual rainfall in Nalgonda District

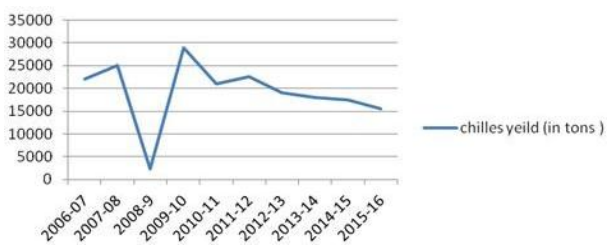


Figure 2 Year wise annual Chillies yield in Nalgonda District

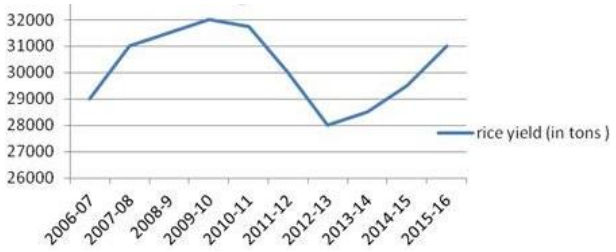


Figure 3 Year wise annual Rice yield in Nalgonda District

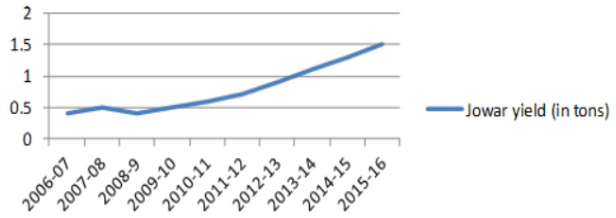


Figure 4 Year wise annual Jowar yield in Nalgonda District

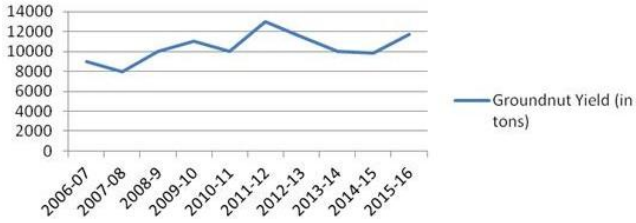


Figure 5 Year wise Groundnut Rice yield in Nalgonda District

As the figure:1 appears there is a great deal of deviation in the amount of rainfall in the year 2009-10 where the rainfall surpasses the ordinary rainfall of 762 mm to 929 mm demonstrating 22.2% deviation. In the year 2008-09 the rainfall recorded was 433.6 mm which was lower than the typical rainfall appearing - 43.7% deviation. There is an abatement in the rate deviation as is delineated by the direct pattern. The above discovering features the fact that there is an adjustment in the rainfall pattern in the present investigation four noteworthy crops developed in the locale for example paddy, groundnut, jowar and chilles were selected to analyze the relationship between's horticultural productivity and rainfall patterns. Information was gathered dependent on variety in yields for the time of 2006 - 07 to 2016 figure (1) to (5) demonstrates the connection between the annual rainfall and the crop yield information. From figure (3) it turns out to be certain that for paddy there is no immediate relationship between's the quantum of rainfall and the crop yield. So to the extent paddy is concerned different factors like normal territory of crop sown, composts, pesticides, different wellsprings of water influence productivity and not rainfall alone. In this investigation for crops like Chillies and jowar a particular positive relationship was seen among yield and rainfall. This connection was set up dependent on an examination of rainfall information for seasonal period and yield expectation models utilizing rainfall and productivity for the period 2006-2016. The figures demonstrate that the consistency of productivity of crops utilizing seasonal rainfall is low at the inside for all crops except groundnut. From figure (4) it turns out to be certain that an immediate connection exists between horticultural productivity and annual rainfall. A diminishing in rainfall results in a decrease in crop yield. Figure 4 and 5 demonstrates that as paddy there is no connection between's the rainfall patterns and the crop yield for chillies and jowar.

Whatever be the annual rainfall the yield has stayed inside the range of 123 to 364kg/ha. As referenced before crops like paddy has a blended response to rainfall thus different parameters must be considered to set up relationship like manures, pesticides, micronutrients and so forth. In this examination a cluster investigation was done for the four crops paddy, chillies, jowar and Groundnut relying upon the consequences of the crop yields and rainfall patterns. To identify the particular cluster of rainfall and crop yields the normal linkage strategy for clustering was embraced. In this technique grouping of the articles (I.e. the N long periods of rainfall – crop yield information in the present case) into area clusters is continued, based on the relative separation between the items, which measure the level of closeness between them. In the examination, dendogram and various leveled clustering between south west rainstorm information, annual rainfall and yield of the four crops – Paddy, jowar, Chillies and Groundnut were done; the cluster investigation was embraced in light of the fact that it gives significant data about the yield response relating to the distinctive kinds of rainfall patterns that happen at the season of the crop development season. The cluster investigation confirms the fact that there is a balanced connection among's rainfall and crop yield the extent that the Groundnut crop is concerned. What's more, as watched prior there is no connection among's rainfall and crop yield with respect to as the Paddy Jowar and Chillies and concerned. What's more, from this it very well may be inferred that for Paddy, Jowar and Chillies crops different wellsprings of water, bug sprays/pesticides and the zone of crop being sown each year should be considered to align horticultural productivity. From the cluster investigation and direct impact of rainfall on rural productivity it becomess evident that there is obvious connection among productivity and climate state of a region. What's more, there it tends to be reasoned that ideas of temperature and rainfall unquestionably influence rural productivity. An endeavor was additionally made, in the examination, to associate the agrarian GDP and the costs. An investigation was finished utilizing the Ordinary least Square Model (OLS) to determine the impact of climate factors on the horticultural

GDP. The information required was accumulated for the period beginning from 2006 to 2016 and the connection between the costs of items for the years considered was completed. The R2 esteems were evaluated utilizing the OLS model and its importance was analyzed for 2 informational indexes (1) Prices, Rainfall and Agricultural productivity and (2) GDP, Prices and Rainfall and Productivity. Table ii shows the R-square, Multiple – R esteems. A comparable report was made on the effect of climate on ware costs and adjusted the effect of climate unsettling influences on product costs and its resultant effect on expansion, trade rates and GDP. The discoveries were that production and costs were additionally influenced by contrasts in rainfall.

Table I – Results of Ordinary least square method (Nalgonda)

Commodities	Prices, Rainfall, Production			GDP, Prices, Rainfall, Production	
	Observations	Multiple R	R Square	Multiple R	R Square
Rice	15	0.67	0.47	0.75	0.63
Groundnut	15	0.47	0.22	0.77	0.65
Chilies	15	0.27	0.4	0.70	0.54
Jowar	15	0.56	0.33	0.74	0.61

6. CONCLUSION

This investigation was led in Nalgonda locale of Telangana, to comprehend the impact of climate change on rural productivity and GDP. The region has 59 mandals. At the mandal and region level, rainfall, temperature and its effect on productivity was analyzed by taking climatic information for a time of 10 years. It is discovered that there was very little deviation in the maximum and minimum temperatures in all the mandals of the locale amid this period. There was a great deal of transgression of rainfall from that of the typical rainfall in the year 2009-10 where it has surpassed the ordinary rainfall by 22%. What's more, in the year 2006-07 the rainfall recorded was not exactly the typical rainfall and the deviation was - 43.7%. For all the 59 mandals of the region the coefficients of change (COV) were determined. As anticipated the investigation demonstrates significant changes in the pattern of rainfall in the mandals selected for the examination. The R2 esteems contrasted from 0.02 to 0.09. Also, this has had its impact on the productivity of Paddy,

Chillies, Jowar and groundnut in the region. To discover the effect of climate change on farming productivity of Paddy, Chillies, Jowar and Groundnut crops, cluster examination and the OLS model were utilized and the investigation demonstrated an immediate impact of rainfall on the productivity of Groundnut and jowar, and it is a blended response for Paddy. In this way it is presumed that both farming productivity and thus horticultural GDP are influenced, as it were, by climatic variations.

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