Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Special Issue [1]2022 : 292-295

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD

REVIEW ARTICLE **OPEN ACCESS**

Impact of climate change on agricultural practices in North Karnataka

D.JoelJebadurai
Assistant Professor Cum ICSSR Project Director, Department of MBA, St.Joseph's College of Engineering, OMR, Chennai, India.
Email ID : joeljebadurai64@gmail.com

ABSTRACT
Agriculture is India's backbone. However, human beings degrade the environment as a result of urbanization and industrialization. It causes environmental disasters such as floods, droughts, cold waves, and heat waves, among other things.The researcher has applied stratified sampling to pick the 1050 farmers in North Karnataka. Mean Score, one-sample t-test, ANOVA is applied. The researcher found that sources of climate risk area significant impactful factor in agriculture. So, the government may support the farmers to minimize the impact of climate change in agriculture.
Keywords: *Climate change, Agriculture, Impact of climate change, Climate risk*

Received 19.02.2022 Revised 14.03.2022 Accepted 04.04.2022

INTRODUCTION

Climate change is a contentious topic all around the world. For the last few centuries, the effects of global climate change have prompted every nation to take steps to prevent it [1]. Agriculture is one of the most significant sectors that is disproportionately affected by global climate change [2]. It's because of the way it interacts with the surroundings. Climate is one of several factors that influence agricultural productivity and population survival [3]. In recent years, industrialization and the use of chemical fertilizers have become a symbol of agricultural sustainability and climatic change. Climate change is caused by both natural and man-made factors [4]. Artificial activities compel citizens to participate. Artificial causes are contributing significantly to a slew of negative environmental consequences.

Climate change

Climate change, as defined by the Intergovernmental Panel on Climate Change (IPCC), is a change in the state of the climate that may be discovered (for example, using statistical tests) by changes in the mean and/or variability of its properties over time, usually decades or more. Any change in climate over time, whether due to natural variability or human activities, is referred to as climate change [5]. This differs from the United Nations Framework Convention on Climate Change (UNFCCC), which defines global climate change as a change in climate that is attributed directly or indirectly to an act that alters the composition of the global atmosphere, as well as natural climate variability observed over comparable time periods.

HISTORICAL EVIDENCE OF CLIMATE CHANGE:

Nature's climate is ever-changing [6]. It is a necessary evil that changes continuously in slow motion. The following are some examples of these phenomena:

1. India's temperature got significantly warmer and more tropical than it would have been if the Himalayas had not prevented cold Central Asian air from reaching the country.
2. Early in the present Holocene period (4800-6300 years ago), parts of what is now the Thar Desert were moist enough to support permanent lakes; researchers have concluded that this was due to significantly greater winter precipitation, which corresponded with stronger monsoons.
3. Similarly, Kashmir's warm subtropical climate transitioned to a much cooler temperate climate 2.6-3.7 million years ago, and it has been routinely subjected to lengthy cold periods since then.
4. The worldwide sea level has increased by roughly 17 cm in the previous century (6.7

inches). However, the rate has almost doubled in the last decade compared to the preceding century.

Climate change impact on Agriculture

Climate change has already affected agriculture and will continue to do so. Increases in temperature, rainfall fluctuation, and, as a result, the frequency and intensity of extreme weather events are increasing strains on global agricultural and food systems as a result of global climate change [7]. In the majority of regions, global climate change is expected to have a detrimental impact on crop and livestock production systems, while certain nations may benefit from the changes. Climate change is exacerbating water scarcity, pollution, and soil degradation.

Agriculture is responsible for a large amount of the greenhouse gas (GHG) emissions that are causing global climate change, accounting for 17% of GHG emissions directly from agricultural operations and another 7–14% through land-use changes. As a consequence, it's both a part of the issue – and potentially a key component of a solution. The most direct agricultural GHG emissions are from soils, fertilisers, manure, and urine from grazing animals, as well as methane generation by ruminant animals and paddy rice agriculture [8]. These gases have far more heating capacity than CO^2.

Forms of climate change impact on agriculture

Climate change showsa number of effects in the agricultural sector. Some of those effects are positive and some are negative. A few of them are as follows as examples:

1. Animal: Heat waves in cattle and buffaloes can reduce milk production by 10-30% in the first lactation and 5-20% in the second and third lactations. They can also alter crossbreed cows and buffaloes' growth, puberty, and maturity.
2. Fish: Fish rearing is impacted by climate change in a number of ways, including the mortality of fish lings in shallow water ponds, a reduction in fish capture in water bodies due to fish migration into deeper layers, and so on. Fish reproduction and migration can be influenced by variations in temperature and season.
3. Crop yield:

a. Warmer temperatures: Many crops may develop more quickly, but yields may suffer as a result. In warmer heat, crops develop faster. Faster growth, on the other hand, reduces the time it takes for seeds to develop and mature in specific crops (such as grains). This has the potential to reduce yields (the amount of crop produced on a given area of land) (EPA)

b. Higher CO2 levels can increase yields. Agricultural yields for key commodities, such as wheat and soybeans, might grow by 30% or more if CO2 levels are doubled. Other crops, such as maize, have a far lower response rate (less than a 10% rise).

4. Crops can be harmed by more severe temperatures and precipitation. Floods and droughts, in particular, can damage crops and lower harvests.
5. Warmer temperatures, wetter climates, and higher CO2 levels favour the growth of many weeds, pests, and fungi. Farmers' crops that had not previously been exposed to these species would face new challenges as a result of this (EPA).
6. Seed quality: Without good seed, which is a basic and crucial input in agriculture, people cannot expect a good yield and high-quality agricultural product. Seed germination, viability, vigour, seed health, and seed appearances, such as size, shape, weight, and colour, are all elements that influence seed quality. Climate factors impact each of these qualities during the crop's growth cycle and subsequent seed processing. If climatic circumstances are unfavourable during crop growth, the low-quality seeds that follow have a lower market value, putting the farmer's profitability in jeopardy.
7. Nutrition quality of crops: Increased CO2 levels reduce protein and other nutritious content while boosting starch and sugar content in many crops under controlled settings.
8. Soil: Climate change is projected to reduce changes in soil mineral composition, organic matter content, and structural stability in many soils (temperature and precipitation). Reduced vegetation or annual or perennial crop cover as a result of any locally significant decreases in rainfall not offset by CO2 effects could result in soil structure degradation and decreased porosity, as well as increased runoff and erosion on sloping sites and more extensive and rapid sedimentation. Climate change may have comparable implications on land-use decisions.
9. Water: In India, agriculture utilises the most surface water, and demand is growing as more land is irrigated. Climate change is affecting the hydrological cycle in a variety of ways, including changes in precipitation patterns, intensity, and extremes, significant melting of snow and ice, increased atmospheric water vapour, higher evaporation, decreased groundwater levels, and changes in soil moisture area.
10. Crop duration: In most of the plant's life cycle, the phase of anthesis is the most essential stage of development. If they occur within a restricted crucial period of only 1-3 days around the time of

blooming, high temperatures (>32o-36oC) can drastically affect seed set and hence crop production in many annual crops.

Methodology

Stratified random sampling has been applied by the researcher to pick the 1050 farmers in the study area. Primary data have been processed by the application of statistical tools such as mean, One-samplet-tests. The objectives of the study are framed byanalyzing the climate risk's effect on the agricultural pattern.

Climate risk and its effect on the agricultural pattern

A variation from the specified environment necessary for agricultural yield is referred to as climate risk. Climate hazards are changes in climatic circumstances such as temperature and rainfall patterns in a specific location, which have a variety of negative consequences for agriculture. Farmers have a tight relationship with agriculture, yet recognizing agricultural climate risk is a difficult challenge for them. The researcher compiled a list of six climate risks that farmers confront in agriculture. Every variable is significant in its own right. The factors were chosen for their influence on agriculture.

Table 1; Climate Risk in Agriculture

Sl. No	Climate risks	Always	Often	Sometimes	Rarely	Never	Total
1.	Drought	229 (21.8)	314 (29.9)	470 (44.8)	11 (1.0)	26 (2.5)	1050 (100)
2.	Scanty rainfall	185 (17.6)	287 (27.3)	550 (52.4)	17 (1.6)	11 (1.0)	1050 (100)
3.	Heat Waves	483 (46.0)	179 (17.0)	373 (35.5)	7 (.7)	8 (.8)	1050 (100)
4.	Pest and Disease attack	441 (42.0)	225 (21.4)	360 (34.3)	10 (1.0)	14 (1.3)	1050 (100)

Source: Primary Data

Table 1 portraits the details about the climate change risk faced by the farmers. A maximum of 52.4% of 550 farmers have sometimes faced scanty rainfall in their agricultural crops. A minimum of .7% of 7 farmers are rarely facing the problem of heatwaves while cultivating their crops.

Table 2: Climate Risk in Agriculture- Descriptive Statistics

Sl. No	Climate risks	N	Mean	SD	Std. Error Mean
1.	Drought	1050	3.67	.908	.02804
2.	Scanty rainfall	1050	3.58	.831	.02564
3.	Heat Waves	1050	4.07	.952	.02938
4.	Pest and Disease attack	1050	4.02	.959	.02962

Source: Primary Data

Table 2 describes the descriptive statistics details of climate risk in agriculture. The major climate risk faced by the farmers in their agricultural field is heat waves (4.07) and the minor risk is a scanty rainfall (3.58).

Climate Risk in Agriculture – One sample T-test

Climate risks are detrimental to agriculture. The researcher identified 6 climate risk impacts on agriculture. In order to find out whether all the risks are significant impactful factors in agriculture, the one-sample t-test is applied. "It is a non-parametric test, applied to examine whether the mean of a population is statistically different from a known or hypothesized value". The null hypothesis is all the climate risks are not a significant impactful risk in agriculture.

Table 3: Climate Risk in Agriculture- One-Sample t-test results

One-Sample Test						
	Test Value = 3					
					95% Confidence Interval of the Difference	
Climate Risks	t	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Drought	24.078	1049	.001	.67524	.6202	.7303
Scanty rainfall	22.953	1049	.001	.58857	.5383	.6389
Heat Waves	36.365	1049	.001	1.06857	1.0109	1.1262
Pest and Disease attack	34.366	1049	.001	1.01810	.9600	1.0762

Source: Primary Data

Table 3 explicate the one-sample t-test output on climate risks involved in agriculture. The null hypothesis is rejected by all variables. It means all variables under the climate risks are significant detrimental factors in agriculture. It is proved by the P-value of all the variables being less than 0.05.

SUGGESTIONS

1. Farmers should be educated about the adaptation strategies to minimize the impact of climate change
2. Government should support the farmers in terms of monetary and non-monetary to minimize the impact of climate change in agriculture.

CONCLUSION

Climate change, according to the researcher, causes several environmental disruptions. As a result, the government must devote greater resources to raising farmers' understanding of climate change mitigation techniques. It can be carried out with the right policy decisions.

ACKNOWLEDGEMENT

This paper is sponsored by the Indian Council of Social Sciences Research under the Major Project. This paper is largely an outcome of the Research Project sponsored by the Indian Council of Social Science Research (ICSSR). However, the responsibility for the facts stated, opinions expressed, and the conclusions drawn is entirely that of the author".

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CITATION OF THIS ARTICLE

D.JoelJebadurai. Impact of climate change on agricultural practices in North Karnataka. Bull. Env.Pharmacol. Life Sci., Spl Issue [1] 2022 : 292-295