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AN OVERVIEW OF INEVITABLE LINKAGE BETWEEN CLIMATE CHANGE AND AGRICULTURE WITH LIVELIHOOD SECURITY IN RURAL INDIA

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ABSTRACT

The staple objective of this research study is to decide the end result of climate change on agriculture which is a premier article for the survival of country networks. This research paper is an endeavor to cover a few parts of the provincial business and the effect of climate change over it. It is found in research that the economy experienced one of the most noticeably awful nourishment emergency with ascendin costs of significant sustenance grains and other sustenance items thusly pushing more individuals towards neediness and extraordinary craving. The antagonistic impacts of environmental change on future nourishment and horticultural creation may additionally worsen high costs, along these lines including further weight farming unfavorably influencing poor people. With the evaluation of defenselessness of provincial poor, the unavoidable linkage among agriculture and atmosphere has been explained in this paper in an illustrative way.

KEYWORDS: *Climate Change, Vulnerability, Agriculture, Rural Livelihood*

INTRODUCTION

The United Nations Framework Convention on Climate Change (UNFCCC) defines Climate Change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."

Climate change will compound existing neediness. The creating countries will be most stroked by the antagonistic effects of environmental change in light of their topographical and climatic conditions, their high reliance on regular assets, and their restricted ability to adjust to an evolving atmosphere. Inside these nations, the most helpless are those least fortunate who have the least assets and minimal ability to adjust.

The effects of climate change and the powerlessness of poor networks to climatic change differ extraordinarily, yet by and large, climate change is superimposed on existing vulnerabilities. Further climate change will diminish access to drinking water, contrarily influence the strength of destitute individuals and represent a risk to sustenance security in numerous nations in Africa, Asia, and Latin America. In certain regions, where the decisions for business are restricted and diminishing harvest yield lead to the circumstance of starvation, relocation there may be the main arrangement.

Climate change is a noteworthy test for agribusiness, nourishment security, and the job of billions of individuals including the country poor. Agribusiness area is most defenseless against climate change because of its high reliance on

atmosphere and climate. Individuals living in rustic regions generally rely upon horticulture for their work and consequently, they will, in general, be less fortunate as contrasted and those living in urban territories. Sustenance security and work rely upon economical horticulture. Farming assumes an indispensable job in adding to all the three segments of nourishment security in particular, sufficient sustenance accessibility, access and suddenness which are required in accomplishing sustenance security in provincial regions.

Objectives of the Study

- To survey the effects of climate change and the helplessness of poor networks with unique reference to agribusiness.
- To discover the connection between climate change on some particular harvests and the state of country poor.

  To assess the shock of climate change on sustenance security in the provincial zone in India and discover the results.

LITERATURE REVIEW

This paper, “The Impact of Climate Change on Agriculture” by Sudarkodi, K. and Sathyabana, K. (2011), gives an understanding into the diverse climate change related difficulties that the rural division will confront and investigates open doors for discharge decrease and adjustment. This paper obviously shows that the division merits more consideration with regards to both climate change dangers and openings. The outcome demonstrates that climate change is probably going to have a critical negative effect on farming creation, provoking yield decrease that will incredibly influence portions of the creating scene.

“Climate Change, Rural livelihoods and Agriculture (Focus on Food Security) in Asia – Pacific region” is presented by S. MahendraDev (2011). The objective of this paper is to recognize climate change related dangers and vulnerabilities related to agribusiness as an area and farming as individuals' employments (introduction, affectability, versatile limit). This paper examination the associations between the idea of human activities as drivers of dangers just as open doors for economical agribusiness and better human advancement results. Extensively, it looks at the effect of climate change on provincial employments, horticulture and sustenance security. He inferred that provincial families get vocations through agribusiness, rustic non-ranch division and movement. Additionally, the wellsprings of jobs contrast starting with one nation then onto the next. Further he reasoned that the effect of watch changes in atmosphere patterns, fluctuation and outrageous occasions demonstrate that the harvest yield in numerous nations of Asia has declined, somewhat because of rising temperatures and extraordinary weather occasions.

Amrit Patel (2011) in his paper, "Climate Change and Agriculture in India: Need for Mitigation and Adaptation" examines so far as India is concerned, climate change is probably going to influence agribusiness unfavorably and increment the danger of appetites and drinking water shortage because of upgraded inconstancy and increasingly quick liquefying of ice sheets. He presumed that agribusiness improvement in India needs to concentrate on lessening ozone-harming substance outflow through different measures, for example, critical decrease of deforestation, improving woods protection and the executives, successful control of out of control fires, advancement of agro-ranger service for sustenance or vitality, soil carbon sequestration, reestablishing land through controlled brushing, improving nourishment for ruminant domesticated animals, productive administration of domesticated animals waste, and creating methodologies that save soil

and water assets by improving their quality, accessibility and effectiveness of utilization.

Singh Mahesh Kumar (2010), in his Ph.D. dissertation on "Socio-Economics of Climate Change: Impact on Agriculture Land Use Changes in India" decides, how the distinctive major financial pointers are fluctuating as indicated by climate change in India and furthermore discover the powerlessness file to decide the effect appraisal. In the meantime, he examined similar varieties underway, yield, development rates and other farming measurements. By estimating the agrarian land use changes and impact of environmental change he gave detail thought regarding how the financial of climate change wonder influence the farming area use change in India.

Shakeel, A. Khan; S. Kumar; M.Z. Hussain and N. Kalra (2009), in their study, "Climate Change, Climate Variability and Indian Agriculture: Impacts, Vulnerability and Adaptation Strategies", expressed that, the effect of climate change and powerlessness on farming is a high need in India as the effect, in the event that it pursues the forecasts, is required to be far-reaching and extreme. Building up the capacity to certainly assess the effects of climate change on agribusiness is basically essential. If at any time accomplished, it could give the worldwide data expected to enable ranchers to build up their very own long-range reaction to climate change. They reasoned that the precision in evaluating the size of the climate change on higher spatial and fleeting goals is the prime prerequisite for exact appraisals of the effect. Financial parts of climate change are generally feeble and future situations are to be produced for different agro-biological districts for in this way connecting with another social layer to work out the effect.

“Climate Change: Perspectives from India” is a collection of articles by Sunita Narain, Jyoti Parikh, Prodipto Ghosh, N.C. Saxena and PreetiSoni (2009). This gathering of articles catches and spreads a few viewpoints on climate change from the Indian point of view. Beginning from contention on another atmosphere arrangement to feature the significance of the little scale modern area inside climate change discusses, a portion of India's best-known tree huggers, financial analysts and approach creators have advanced their worries and feelings in this gathering. Sunita Narain contends that, "there isn't much distinction between dealing with nearby timberland and the worldwide atmosphere. Both are basic property assets. What is required above all is a property rights structure, which supports collaboration". Prodipto Ghosh examination draws out that a nation can have both development and less carbon discharge. N.C. Saxena unequivocally advocates adjustment to climate change through soil and water protection. Jyoti Parikh has recognized the extraordinary vulnerabilities of ladies to climate change. Preeti Soni has brought into the center a vital however overlooked segment: the little scale enterprises. She has recognized manners by which this part can be made vitality productive.

RESEARCH METHODOLOGY

The design of this research paper is analytical cum conceptual based on secondary data. The secondary data has been collected from statistical bulletin published by various organizations, books, journals, periodicals, newspapers and annual reports. A descriptive approach has been adopted for finding the impact of climate change on agriculture and rural livelihood. Several factsheets and manuals have been assessed for the optimal outcome of this research study.

Climate Change and Agriculture: their Inevitable Linkage

The Impact of climate change on agrarian creation and utilization relies upon a blend of common and human activities. The climate change can have both positive and negative impacts relying upon the area. For instance, in certain regions, climate change lessens crop yields which it increments in some different zones. Correspondingly, human activities

will have both positive and negative consequences for agrarian generation and utilization. These activities can have a positive effect on adjustment and alleviation of climate change and diminish the effect of climate change on farming, food security, and employment. It can have a negative effect if unsustainable generation and utilization rehearses are pursued. Climate change and farming both are interconnected and climate change throughout the following century may effectively affect nourishment accessibility and harvest generation. It is anticipated that by 2050, there would not be any ice sheet on the planet and dissolving of ice would result in repetitive floods and noteworthy ascent in ocean level (Cassman, K.G., 2007). Floods will crash standing yields; the backwoods flame will be a typical event in dry spell influenced territories, more water will be required for the water system, cultivable land will wind up sterile, and precipitation at provincial dimension hint at an expanding or diminishing pattern. These progressions will thus intensify the current biological system. Likewise, the harvest examples will be influenced by the progressions in agro frameworks. In India, the impacts of a worldwide temperature alteration are probably going to be progressively serious. A developing total populace joined with the relentless impacts of climate change is estimated to make a worldwide sustenance lack in the following 10 years. India isn't extraordinary, its 52 percent working populaces rely upon horticulture and about 70 percent populace lived in provincial zones where farming is the biggest help to employment (Economic Outlook, 2010-ll). In India, as atmosphere changes, there will be an increment in the interest for nourishment to 276 million tons by 2021 as against momentum creation of 230 million tons that may expand the challenge for assets utilize, for example, land, water, capital, work, and different valuable characteristic assets. In India, out of the complete 329 million hectares of topographical territory, 174 million hectares or 53 percent of the all-out land zone is experiencing genuine debasement. Of this, 144 million hectares' region is exposed to water and wind disintegration and 30 million hectares is corrupted through extraordinary issues like gorges, saltiness, water logging and so forth. (Koty Reddy T., 2010). 33% of our property underwood's, almost 66% of land under horticulture and about all cultivable waste terrains, lasting field, and nibbling lands are in critical need of protection measures (K.G. Tejwani, 1982). Land corruption due to overgrazing has prompted desert-like conditions in numerous pieces of the nation. The accompanying tables give all India region (in million hectares), creation (in million tons) and yield (in Kg per hectare) of some regular harvests primarily Rice, Wheat, Coarse Cereals and Total Pulses alongside inclusion underwater system (in percent) which is the principal wellspring of country jobs.

Table 1: All India Area, Production and Yield of Rice along-with Coverage under Irrigation from 2000-01 to 2010-11

Year	Area Million Hectares	Production Million Tonnes	Yield Kg/Hectare	Area Under Irrigation (Percent)
2000-01	44.71	84.98	1901	53.6
2001-02	44.90	93.34	2079	53.2
2002-03	41.18	71.82	1744	50.2
2003-04	42.59	88.53	2077	52.6
2004-05	41.91	83.13	1984	54.7
2005-06	43.66	91.79	2102	56.0
2006-07	43.81	93.36	2131	56.7
2007-08	43.91	96.69	2202	56.9
2008-09	45.54	99.18	2178	NA
2009-10	41.85	89.13	2130	NA
2010-11	36.95	95.98	2177	NA

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2010-11) at www.agricoop.co.in

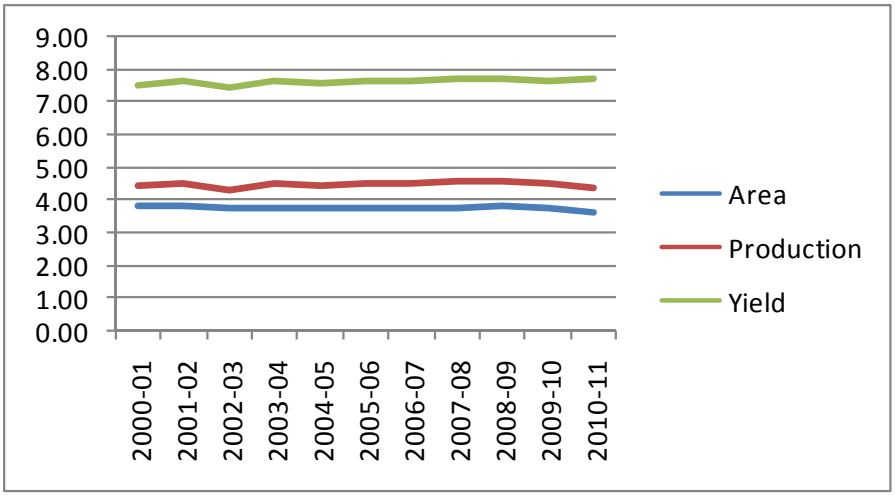

Figure 1: Area, Production and Yield of Rice from 2000-01 to 2010-11

Table 1 shows that in 2000-01 the area under cultivation for rice crop was 44.71 million hectares and the production was 84.98 million tonnes and the yield was 1901 Kg per hectare. However, the area under irrigation was 53.6 percent during the same year. In 2001-02, the area increases a little to 44.90 million hectares but the production and yield increase more to 93.34 million tonnes and 2079 Kg per hectare respectively. But the area under irrigation decreases to 53.2 percent. In 2002-03, area, production and yield all decline to 41.18 million hectares, 71.82 million tonnes and 1744 Kg per hectare respectively. This goes to a maximum of 45.54 million hectares' area and 99.18 million tonnes production in 2008-09 and to the minimum of 36.95 million hectares' area and 80.41 million tonnes production of rice in 2010-11. However, the yield was maximum in 2007-08 i.e. 2202 Kg per hectare and minimum in 2005-06 i.e. 2102 Kg per hectare.

The Area, production and yield of rice from 2000-01 to 2010-11 can be clearly understood will the help of line graph shown in figure 1.1 above.

Table 2: All India Area, Production and Yield of Wheat along-with Coverage under Irrigation from 2000-01 to 2009-10

Year	Area Million Hectares	Production Million Tonnes	Yield Kg / Hectare	Area Under Irrigation (Percent)
2000-01	25.73	69.68	2708	88.1
2001-02	26.34	72.77	2762	87.4
2002-03	25.20	65.76	2610	88.0
2003-04	26.60	72.15	2713	88.4
2004-05	26.38	68.64	2602	89.4
2005-06	26.48	69.35	2619	89.6
2006-07	27.99	75.81	2708	90.2
2007-08	28.04	78.57	2802	90.9
2008-09	27.75	80.68	2907	NA
2009-10	28.52	80.80	2830	NA

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2010-11) at www.agricoop.co.in

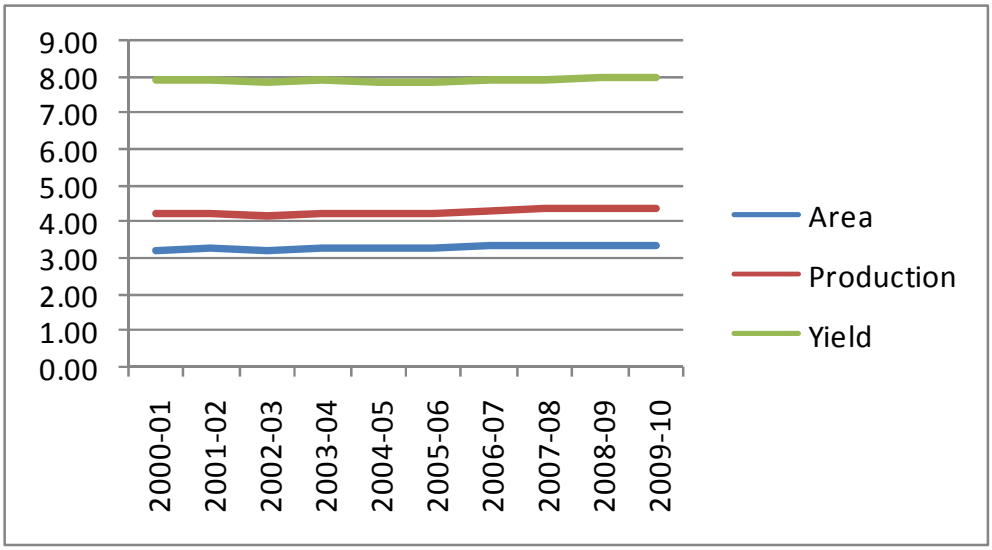

Figure 2: Area, Production and Yield of Wheat from 2000-01 to 2009-10

Table 2 shows that the production of wheat in 2000-01 was 25.73 million tonnes and the yield was 2708 Kg per hectare. While the area under cultivation and irrigation was 25.73 million hectares and 88.1 percent respectively. In 2001-02 the area, production and yield slightly increase to 26.34 million hectares, 72.77 million tonnes and 2762 Kg per hectare respectively while the area under irrigation slightly declines to 87.4 percent. The area and production go to a maximum of 28.52 million hectares and 80.71 million tonnes in 2009-10. But the yield was maximum in 2008-09 i.e. 2907 Kg per hectares.

Figure 2 above shows the line graph of the area, production and yield of wheat as given in table 4.2 and explained above.

Table 3: All India Area, Production and Yield of Coarse Cereals along-with Coverage under Irrigation from 2000-01 to 2010-11

Year	Area Million Hectares	Production Million Tonnes	Yield Kg / Hectare	Area Under Irrigation (Percent)
2000-01	30.26	31.08	1027	12.5
2001-02	29.52	33.38	1131	11.3
2002-03	26.99	26.07	966	11.0
2003-04	30.80	37.60	1221	6.6
2004-05	29.03	33.47	1153	6.6
2005-06	29.04	34.07	1172	13.0
2006-07	28.71	33.92	1182	13.4
2007-08	28.48	40.75	1431	14.2
2008-09	27.45	40.04	1459	NA
2009-10	27.64	33.77	1222	NA
2010-11	20.94	43.68	1348	NA

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2010-11) at www.agricoop.co.in

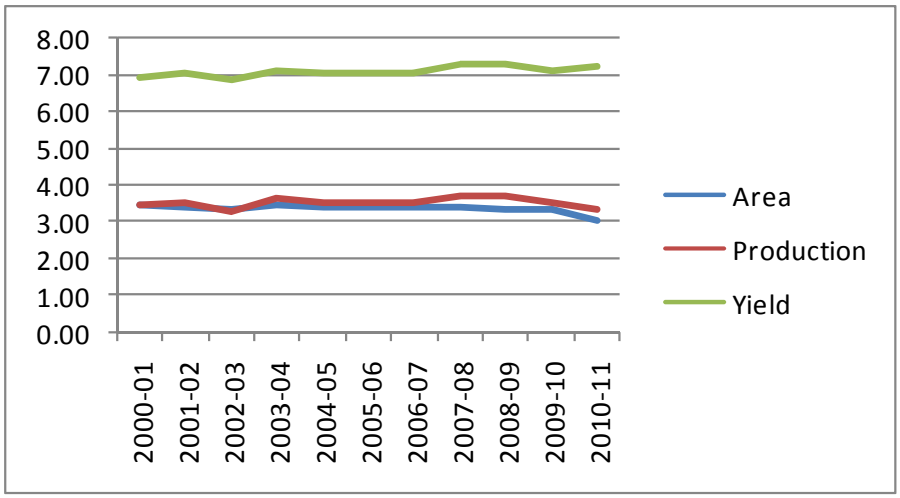

Figure 3: Area, Production and Yield of Coarse Cereals from 2000-01 to 2010-11

Table 3 gives the production and yield of coarse cereals as 31.08 million tonnes and 1027 Kg per hectare respectively in 2000-01. Also the area under cultivation and irrigation was 30.26 million hectares and 12.5 percent respectively during that year. In 2001-02, the area under cultivation declines to 29.52 million hectares but the production and yield increase to 33.38 million tonnes and 1131 Kg per hectare respectively. In 2002-03, area, production and yield all decline to 26.99 million hectares, 26.07 million tonnes and 966 Kg per hectare respectively. The maximum area under cultivation was 30.80 million hectares in 2003-04 and the minimum area was 20.94 million hectares in 2010-11. Maximum production of coarse cereals was 40.75 million tonnes in 2007-08 and the minimum was 26.07 million tonnes in 2002-03. Maximum yield was 1459 Kg per hectare in 2008-09 and the minimum was 966 Kg per hectare in 2002-03.

This maximum and minimum production and yield can be clearly seen through the graph shown above in figure 1.3.

Table 4: All India Area, Production and Yield of Total Pulses along-with Coverage under Irrigation from 2000-01 to 2010-11

Year	Area ('000 Hectares)	Production (Tonnes)	Yield (Kg/Hectare)	Area Under Irrigation (Percent)
2000-01	20.35	11.08	544	12.5
2001-02	22.01	13.37	607	13.3
2002-03	20.50	11.13	543	14.4
2003-04	23.46	14.91	635	13.6
2004-05	22.76	13.13	577	13.9
2005-06	22.39	13.39	598	15.0
2006-07	23.19	14.20	612	15.4
2007-08	23.63	14.76	625	16.2
2008-09	22.09	14.57	659	NA
2009-10	23.35	14.60	625	NA
2010-11	11.16	18.24	537	NA

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2010-11) at www.agricoop.co.in

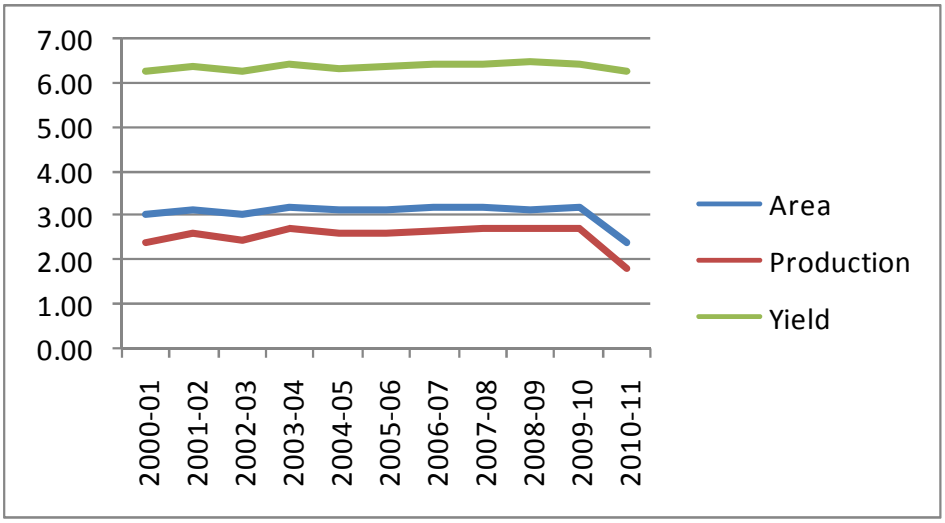

Figure 4: Area, Production and Yield of Total Pulses from 2000-01 to 2010-11

According to table 4, the area under cultivation for total pulses was 20.35 million hectares while the production and yield were 11.08 million tonnes and 544 Kg per hectare respectively. This increased to 22.01 million hectares, 13.37 million tonnes and 607 Kg per hectare respectively in 2001-02. The area and production of total pulses go to a maximum of 23.63 million hectares and 14.76 million tonnes respectively in 2007-08 and to a minimum of 11.16 million hectares and 6.00 million tonnes respectively in 2010-11. However, the yield was maximum in 2008-09 i.e. 659 Kg per hectare and minimum in 2010-11 i.e. 537 Kg per hectare.

The area, production and yield of total pulses can be better understood with the help of line graph presented above in figure 1.4.

Impact of Climate Change on Rural Livelihoods

The climate change is as of now having an effect on the lives of the populace especially poor people. Predictable warming patterns and increasingly visit and exceptional outrageous climate occasions, for example, dry seasons, violent winds, floods and hailstorms have been seen in ongoing decades. India has countless individuals. Neediness is identified with the introduction of atmosphere dangers. The lives of the poor are influenced by the dangers and vulnerabilities that accompany a dubious atmosphere. Climate change will bit by bit further increment their dangers and vulnerabilities, putting weight on effectively over-extended adapting techniques and amplifying imbalances dependent on sexual orientation and different drawbacks (UNDP, 2007).

There are notable misfortunes because of the effect of environmental change on horticulture as a decrease in jobs and salaries of the general population. Be that as it may, the unfavorable effect of climate change on human advancement is less comprehended and belittled. The outrageous atmosphere occasions, for example, dry spells, floods and violent winds can affect human advancement. An atmosphere stun influences occupations from numerous points of view. They crash crops, lessen open doors for business, push up nourishment costs and devastate property, defying individuals with constrained decisions. The rich can adapt up to these stuns through private protection, by auctioning off resources, or by the illustration on their investment funds. Then again, the poor diminishesutilization, cut nourishment, remove kids from

school, or sell the profitable resources on which their recuperation depends. These are the decisions that limit human abilities and fortify disparities (UNDP, 2007).

Jobs can be influenced unfavorably because of defenselessness in climate change for the poor. It is generally affirmed that poor people will be hardest hit by the effects of climate change, particularly those whose occupations are most intensely subject to characteristic assets. The most defenseless individuals will experience the ill effects of climate change. Climatic perils, for example, floods can seriously influence the provincial job by harming crops, houses, open utilities, cow's misfortune and so forth. The extent of flooding has expanded in the late decades. Floods have happened pretty much consistently since 1980 and were considerable in 2003 because of across the board rains, which influenced even the absolute driest season – inclined zones.

Table 5: Flood Damages in India

Flood Damages in India	2008	Maximum Damage	Year of Maximum Damage
Affected area (million hectares-Mha)	3.55	17.50	1978
Population affected (millions)	41.46	70.45	1978
Damage to crops (Rscrores)	1,336.32	4,246.62	2000
Damage to houses (Rscrores)	1,011.97	1,307.89	1995
Damages to public utilities (Rscrores)	1,591.62	5,604.46	2001
Cattle Lost ('000)	71	618	1979
Human life lost (No.)	2,439	11,316	1977
Total damages to crops, houses and public utilities (Rscrores)	3,939.90	8,864.54	2000

Source: Central Water Commission (2010), Water and Related Statistics.

As shown in the above table 5, the flood affected area in 2008 was 3.55 Mha, while the maximum affected area was 17.50 Mha in 1978. Population affected due to flood in 2008 was 41.46 million while it was maximum in 1978 i.e. 70.45 million. Damage to crops due to flood in 2008 was of 1336.32 crores which hardly hit the rural poor's. However, the damage to crops was maximum of 4246.62 crores in 2000. The cost of flood-damaged houses was 1011.97 crores in 2008 and 1307.89 crores in 1995 which was maximum. The maximum damage to public utilities was of 5604.46 crores in 2001. Cattle loss was 71 per 1000 in 2008 and 618 per 1000 in 1979. Human life loss was 2439 in 2008 and 11316 in 1977 due to flood. In addition, epidemics in the aftermath of flood events are also responsible for considerable loss of human lives.

Climate Change, Food Security and Rural Poor

India is a huge creating nation with about 55 percent of the populace depending specifically on the atmosphere touchy parts, for example, horticulture, fisheries and backwoods. Climate change is probably going to have suggestions on sustenance creation, water supply, biodiversity and occupations. An extensive piece of the Indian agribusiness relies upon storm with the goal that the variances can be found in the market of horticulture and fundamental wares because of ahead of schedule or postponed landing of the rainstorm.

Any adjustment in nation's precipitation design impacts farming and thus the nation's economy and nourishment security.

The Food and Agriculture Organization (FAO, 2002) characterizes sustenance security as "a circumstance that exists when all individuals, consistently, have physical, social, and financial access to adequate, protected and nutritious nourishment that meets their dietary need and sustenance inclinations for a functioning and solid life". To have enough eating routine is a fundamental right of each human. In any case, in India, by and by nourishment security is unreliable and it might maybe fall in future. This is on the grounds that nourishment isn't accessible with the suggested amount of supplements and the number of undernourished individuals is rising each year (Gahukar, R.T., 1994).

As per the evaluations of the International Food Policy Research Institute, anextra 38 percent rice ought to be delivered by 2025 to guarantee the developing interest. The farming area supplies almost 90 percent of human sustenance prerequisites and the nourishment generation have expanded by about sevenfold amid the only remaining century (Ramana, A.V., 2008). In spite of the fact that, with the advanced innovations and movement in science, individual has accomplished control on numerous elements, for example, soil, seed, treatment and plant assurance however the control on climate is as yet not accomplished, it is as yet a key factor in agrarian productivity (PrajapatiMinaxi R., 2011).

Since, farming isn't just a wellspring of the product nourishment yet in addition a wellspring of pay, in this way it is basic to trim down the effect of agribusiness on condition. The brief span of the developing time frame, a decline in water accessibility and poor verbalization are likely the reasons for the decrease in the potential yields. Farming generation, for example, material items, therapeutic plants, agriculture, woodland incomes, dairy side-effects and other universally exchanged produce continue the economy of the country (Selwaraj, An., and Maheswari, T., 2008).

Impact of Climate Change on Food Security

Food security is identified with climate change both specifically and by implication. Yields generation and development is represented by atmosphere parameters. Any adjustment in temperature and moistness will directly affect the nature of nourishment created. Circuitous linkages relate to disastrous occasions, for example, floods and dry seasons which are anticipated to duplicate as outcomes of climate change prompting immense harvest misfortune and leaving vast patches of arable land unfit for development, and consequently undermining for sustenance security (Chaudhry Anita, Aggarwal P.K., 2007). Further, climate change and food security are additionally related in light of the fact that climate change can specifically influence a nation's capacity to bolster its kin, however all nations are not similarly influenced. The performance of India’s food grains production is given in the following table 6.

Table 6: Season-Wise Area, Production and Yield of Food Grains from 1990-91 to 2009-10

Year		Kharif			Rabi			Total	
1	A 2	P 3	Y 4	A 5	P 6	Y 7	A 8	P 9	Y 10
1990-91	80.78	99.44	1231	47.06	76.95	1635	127.84	176.39	1380
1991-92	78.02	91.59	1174	43.85	76.79	1751	121.87	168.38	1382
1992-93	77.92	101.47	1302	45.23	78.01	1725	123.15	179.48	1457
1993-94	75.81	100.40	1324	46.94	83.86	1787	122.75	84.26	1501
1994-95	75.19	101.09	1344	48.67	90.41	1858	123.86	191.50	1546
1995-96	73.60	95.12	1292	47.42	85.30	1799	121.02	180.42	1491
1996-97	75.34	103.92	1379	48.24	95.52	1980	123.58	199.44	1614
1997-98	74.15	101.58	1370	49.70	90.68	1825	123.85	192.26	1552
1998-99	73.99	102.91	1391	51.18	100.69	1967	125.17	203.60	1627
1999-00	73.24	105.51	1441	49.87	104.29	2091	123.11	209.80	1704
2000-01	75.22	102.09	1357	45.83	94.73	2067	121.05	196.81	1626

Table 6 Contd.,									
2001-02	74.23	112.07	1510	48.55	100.78	2076	122.78	212.85	1734
2002-03	68.56	87.22	1272	45.30	87.55	1933	113.86	174.77	1535
2003-04	75.44	117.00	1551	48.01	96.19	2004	123.45	213.19	1727
2004-05	72.26	103.31	1430	47.82	95.05	2004	120.08	198.36	1652
2005-06	72.72	109.87	1511	48.88	98.73	2020	121.60	208.60	1715
2006-07	72.67	110.58	1522	51.04	106.71	2091	123.71	217.28	1756
2007-08	73.56	120.96	1644	50.51	109.82	2174	124.07	230.78	I860
2008-09	71.43	118.14	1654	51.40	116.33	2263	122.83	234.47	1909
2009-10	69.33	103.84	1498	52.04	114.36	2197	121.37	218.20	1798

A – Area (in Million Hectares)

P – Production (in Million Tonnes)

Y – Yield (in Kg. /Hectare)

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2010-11) at www.agricoop.co.in

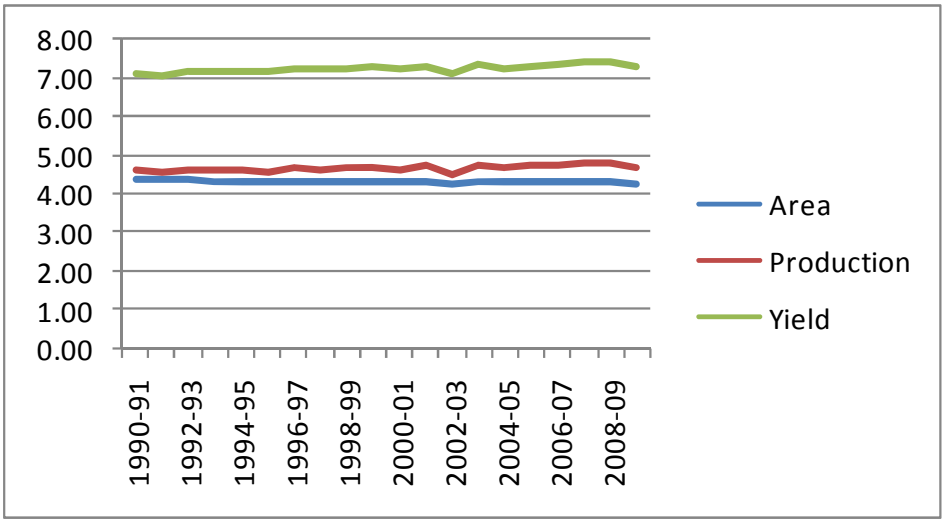

Figure 5: Area, Production and Yield of Kharif Crops from 1990-91 to 2009-10

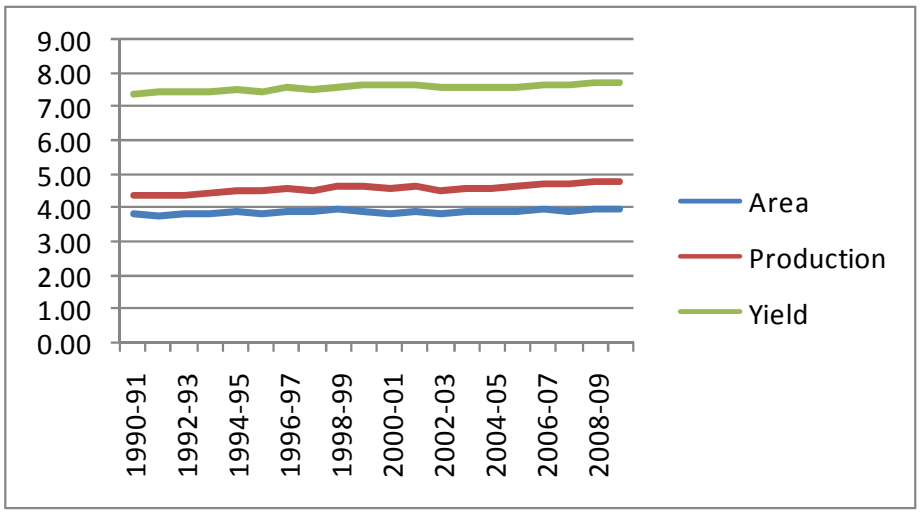

Figure 6: Area, Production and Yield of Rabi Crops from 1990-91 to 2009-10

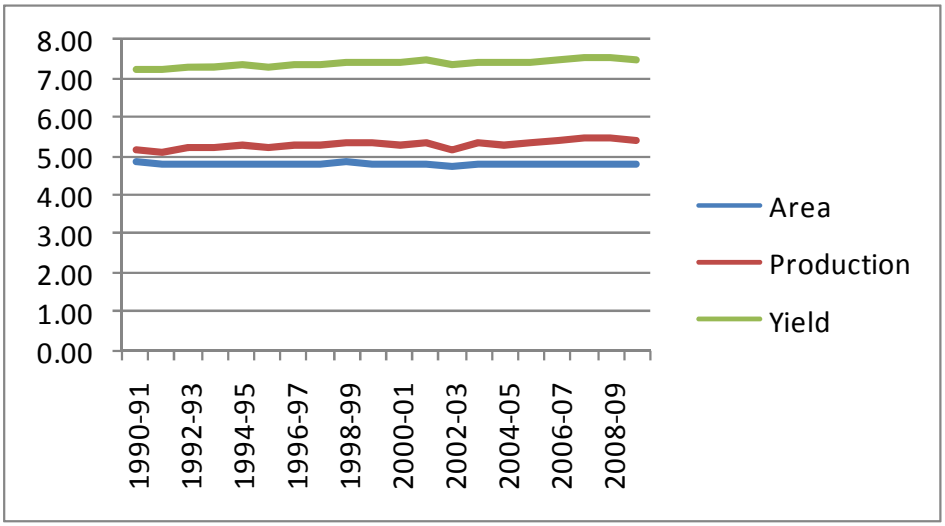

Figure 7: Area, Production and Yield of Total Food grains from 1990-91 to 2009-10

The above table 6 provides the area (in million hectares), production (in million tonnes) and yield (in Kg per hectare) of food-grains during Kharif and Rabi season from 1990-91 to 2009-10.

According to the table, in 1990-91, the area under cultivation for Kharif crops was 80.78 million hectares and the production and yield were 99.44 million tonnes and 1231 Kg per hectare respectively. But the area under cultivation for Rabi crops was 47.06 million hectares which is much less than that of Kharif crop. Production of Rabi crops was 76.95 million tonnes and the yield was 1635 Kg per hectare during that same year. After this year there is a continuous fall in the area, production and yield of both the seasons and it goes to the minimum of 68.56 million hectares' area, 87.22 million tonnes production and 1272 Kg per hectare yield during the Kharif season in the year 2002-03 and during the Rabi season it was the minimum of 45.30 million hectares, 87.55 million tonnes and 1933 Kg per hectare respectively in the same year 2002-03.

All these slightly increases to 69.33 million hectares, 103.84 million tonnes and 1498 Kg per hectare respectively in 2009-10 for Kharif season and 52.04 million hectares' area, 114.36 million tonnes production and 2197 Kg per hectare yield for Rabi season. The fluctuations can be seen in the entire table during both the seasons.

The area, production and yield of Kharif crops, Rabi crops and Total Foodgrains can be better understood with the help of line graph shown in above figure 1.5, figure 1.6 and figure 1.7.

Indian climate is particularly appropriate for the development of the greater part of the yields in various pieces of our nation in light of vast scale varieties in the climate over the district. Be that as it may, Indian soil is most appropriate for the development of foodgrains especially Wheat and Rice.

The creation of wheat is done in the Rabi season when the precipitation is restricted. As a result of this season the creation of wheat found essentially in Punjab, Haryana and Western Uttar Pradesh where there is the accessibility of guaranteed water system. Since wheat generation is vigorously needy upon guaranteed water system, in this manner an adjustment in temperature is relied upon to influence the creation of wheat.

Rice is a noteworthy yield of Kharif season in which water system is required in bigger quality that is accessible in India amid this season through the storm. A persistent downpour all through the season likewise keeps up the temperature variances. In this manner, climate change should affect crops amid the season not just through changes in the amount and example of precipitation yet additionally from changes in temperature. This can be easily analyzed from the above table 6.

The impact of climate change can be effectively observed from the way that there is a substantial scale vacillation in the region under development in the Kharif season. It tends to be effectively observed that when region under development has fallen it has diminished the all-out generation just as efficiency and given an obvious sign that climate change has assumed an essential job in the development of yields amid the harvests season.

In contrast with the Kharif season the change in the zone under development in Rabi season is low that might be brought about by the accessibility of guaranteed water system offices. The variance in the generation just as efficiency is likewise acknowledged alongside the change in the zone under development.

A similar outcome can be discovered if there should be an occurrence of absolute nourishment grains generation. An adjustment in territory under development is constantly joined by change underway and yield of the sustenance grains. It can along these lines be said that the components which are in charge of the adjustment in territory under development are additionally in charge of creation and yield of the harvests in which the climate change is the most imperative and commanding.

Sustenance security is barely characterized as whether food is accessible, however whether the money related and non-fiscal assets at the transfer of the populace are adequate to allow everybody accesses to enough amounts and characteristics of nourishment (Schmidhuber and Tubiello, 2007). Environmental change influences each of the four elements of food security for example food creation and accessibility, soundness of sustenance supplies, access to food, and food utilization (IPCC, 2007).

Atmosphere essentially influences food generation straightforwardly through changes in agro-biological conditions and in a roundabout way by influencing extension and dissemination of livelihoods, and in this way demands

horticulture produce. Atmosphere conditions are anticipated to wind up patchier than at present, with expanding recurrence and seriousness of extraordinary occasions. A strength of sustenance supplies and food security can antagonistically influence by varieties in harvest yields and nearby food supplies. Climatic vacillations will be most set apart in semi-dry and sub-sticky districts and are probably going to lessen crop yields, domesticated animal's numbers and efficiency.

Access to food alludes to the limit of people, networks and nations to gain sustenance in sufficient amounts and quality. In the course of the most recent 30 years' decline in genuine costs for food and increment in genuine wages have prompted significant enhancements in access to sustenance in many creating nations. An increment in food cost and a decline in the rate of salary development coming about because of climate change may upset this pattern.

CONCLUSIONS

This research paper has dissected the center connection between climate change and agriculture in provincial India, the effect of climate change on the creation of yields has likewise been evaluated. We found that climate change has an immediate and unfavorable impact on agriculture which makes dreary outcomes for country work. In the whole research we have look at the effects of climate change on horticulture, food grains generation and efficiency, country occupation, sustenance security, water accessibility, animals and fisheries. Climate change has a mostly negative impact on these. It is a disturbing issue and endeavors must be coordinated towards the minimization of the unsafe impact of climate change.

Finally, we presumed that we have to focus on this issue generally climate change may begin an endless loop where transferable maladies, including water-borne ailments, cause or compound appetite, which thusly, makes the influenced populace progressively defenseless against those infections. Results may incorporate decreases in sustenance utilization and expansion in neediness, horribleness and death rates.

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