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IMPACT OF CLIMATE CHANGE ON CIRCULAR AGRICULTURE PRACTICES

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Abstract

Circular agriculture practices and climate change are closely related, offering opportunities and challenges. This paper explores the complex relationship between the changing climate and the adoption and effectiveness of circular agricultural practices. Circular agriculture offers tools like diversification, biochar application, and rainwater harvesting to build resilience against climate change impacts and ensure food security. This paper will discuss how traditional agricultural systems are disrupted by rising temperatures, shifting precipitation patterns, extreme weather, and water scarcity. Also, circular agriculture can help reduce greenhouse gas emissions and mitigate climate change by improving soil health, composting, and using fewer synthetic inputs. These practices help to retain carbon and reduce greenhouse gas emissions. The approach of circular agriculture has excellent potential to mitigate and adapt to the effects of climate change. These methods will help build a more resilient and sustainable agricultural future by tackling current issues and seizing opportunities.

Keywords: Climate Change, Circular Agriculture, Temperature, Energy, Recycling

INTRODUCTION

We must distinguish between weather and climate to understand climate change. The natural climate conditions we are currently experiencing are called the weather. It also covers anticipated changes in temperature and precipitation over the following few days. The term "climate" describes typical weather patterns in a particular area. Agriculture is the prime source of income for rural households and, consequently, living conditions. It is a well-known fact that most rural families depend upon agriculture as a source of income. Climate change adversely affects agricultural development **(P.S.Kamble, 2016)**, which encompasses elucidating possible circumstances**.** A rise of 2.5-4.5 ∘ C is expected in the global temperature until the end of the 21st century **(Vijai C, 2023)**. Currently, 70% of greenhouse gas (GHG) emissions worldwide are attributable to the extraction and use of materials. Accordingly, "hot spots" of unsustainable consumption and production in high-impact industries like industry, building and construction, and agriculture must be examined to cut emissions drastically. Global industrialisation and unsustainable dependency on non-renewable energy sources have led to an increase in solid waste and climate change, asking for policies to implement a circular economy in all sectors to reduce carbon emissions by 45% by 2030 and to attain carbon neutrality by 2050. We examine circular economy tactics emphasising waste management, energy, climate change, land usage, industry, food production, air and water quality, life cycle evaluation, and economic approaches.

REVIEW OF THE LITERATURE

Climate change is one global problem that causes significant challenges to agriculture. It is causing changes in temperature, precipitation, and extreme weather patterns, impacting food availability, agricultural production, and farming communities' standard of living. This session looks at how changing climatic conditions are moving these aspects and how agriculture is being affected by climate change. **(C.Vijai2023**) Global CO2 emissions have risen despite decades of political promises, research, and innovative applications to mitigate the causes and devastating effects of climate change. To expedite the transition to a just, sustainable, liveable, post-fossil carbon society, fast actions towards carbon neutrality are necessary to meet more strict reduction targets 14% of the world's yearly greenhouse gas (GHG) emissions are attributable to conventional agriculture, and another 17% are being caused by changes in land use, primarily in emerging nations. This is a result of the greenhouse gas emissions from its farming operations, the transportation of food to processing facilities, distribution, marketing, food use, and food waste (Donald et al. Yrjälä2023). The circular economy (CE) could significantly improve how the world addresses climate catastrophes. This study aimed to use a knowledge mapping method to analyse the scientific literature on the relationship between climate change and CE. Based on 789 peer-reviewed publications from Scopus, climate change and CE research are consistently rising and interdisciplinary.(Felipe Romero-Perdomo, Juan David Carvajalino-Umaña et.al 2021)Global climate change is a shift in the long-term weather patterns that define different world sections. "Weather" means short-term variations in a region's temperature, wind, and precipitation. Agriculture may be impacted by long-term climate change in several ways, such as growth rates, photosynthesis and transpiration rates, moisture availability, crop quantity and quality, and agricultural production. It is anticipated that climate change will have a direct impact on food production globally (Anupama Mahato 2014); after a review of the literature relevant to the present topic, it is found that sufficient research work has not been carried out to find out the recent trend in climate change impact on various sectors, but very few studies on climate change impact, Impact of Climate Change on Circular Agriculture Practices.

RESEARCH GAP

The previous review of some critical research studies reveals that there are Research studies on climate change but very few studies on the "Impact of Climate Change on Circular Agriculture Practices." These studies are from macro and national perspectives. There is much scope and relevance for the current research to be undertaken because of the impact of the rise in temperature and heavy rainfall; consequently, renewable energy and organic farming have not yet been discussed or addressed. Hence, it is very urgent, necessary, and relevant to take up the current research study, which will significantly fill the research gap on this research topic.

OBJECTIVES OF STUDY

1. To examine the impact of climate change on various aspects of circular Agriculture
2. To analyze the adaptability of circular agriculture practices to climate change

RESEARCH METHODOLOGY

The present study examines the Impact of Climate Change on Circular Agriculture Practices. The study is mainly based on secondary data that has been collected from sources such as the Government of India economic survey, Annual climate summary, IPCC report 2023, and Ellen Mac author foundation to evaluate the significant contributors to global warming and, in turn, climate change, with a focus on India. Also, use the circular economy indicator to show circular agriculture practices like renewable energy and organic farming. For the latest study period from 2011-2022. The prime objective of the present study is to assess the impact of climate change on various aspects of circular Agriculture in India and the current state of climate change with emphasis on India.

RESULTS AND DISCUSSION

A present research analysis of the Impact of Climate Change on Circular Agriculture Practices this paper shows the negative impact of climate change on agriculture. Increasing temperatures and heavy rainfall are the two climate factors affecting agriculture. Crops, livestock, soil and water resources, rural communities, and agricultural laborers are all vulnerable to the effects of climate change. However, the greenhouse gasses the agriculture industry releases into the atmosphere also affect climate change. The circular economy is a model of production and consumption. It means cutting waste to the absolute minimum. Recycling helps ensure that resources from products nearing the end of their useful lives are preserved in the economy wherever possible. These can be productively utilised repeatedly, adding even more value.

INDIAN SCENARIO OF CLIMATE CHANGE

India ranks fourth on the list of nations most affected by climate change in 2015. Since the middle of the 20th century, India has seen several changes to the monsoon system, such as an increase in the frequency of severe cyclones, a decrease in monsoon precipitation, an increase in extreme weather events such as temperature and rainfall, droughts, and sea level rise. In the worst scenario, the average surface air temperature over India would rise by 4.40C by the end of the century relative to the 1976–2005 period. India has submitted updated climate change pledges to the UN based on its commitments under the Paris Agreement. India has committed to achieving net-zero emissions by 2070 (Vijai C, 2023). Many environmental and socioeconomic issues are part of the climate change scenario in India. India's huge population, dependence on agriculture, and extensive coastline areas make it highly vulnerable to the effects of climate change. These are a few critical aspects of the climate change situation in India.

Here are some critical aspects of the Indian scenario of climate change's impact on agriculture

1. Reduced crop yields	Increased frequency of extreme weather events like droughts and floods, altered rainfall patterns, and rising temperatures may adversely affect crops and lower yields. Food shortages and price increases may result, especially in vulnerable areas.
2. Water scarcity	Farmers find it challenging to irrigate their crops due to water scarcity in many locations caused by increased evaporation and changed precipitation patterns. This may result in even lower yields and further stress on already limited water supplies.

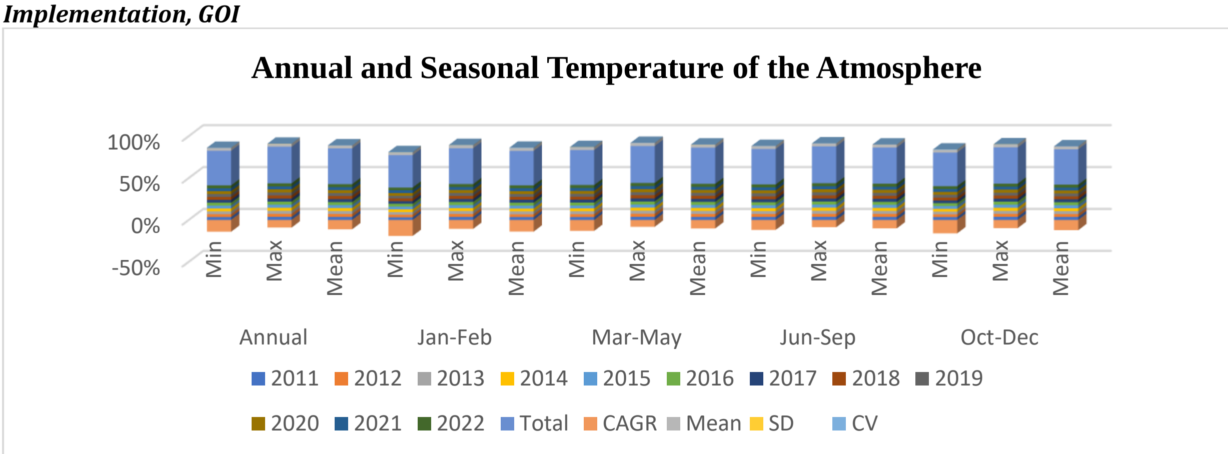
3. Soil degradation	Fertility loss and soil erosion can be caused by severe rainfall and changes in land usage. This lowers agricultural land's long-term productivity and hinders crop advancement.
4. Nutritional quality	Increasing CO2 levels may sometimes promote plant development, but they can also make some crops less nutritious. This can cause people who depend on certain crops for their food to become deficient in critical minerals and vitamins.

Source: (Climate et al. Assessment2021)

Table 1: Annual and Seasonal Temperature of the Atmosphere

		Annual			Jan-Feb			Mar-May			Jun-Sep			Oct-Dec		
Sr. no	**Year**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
1	2011	20.4	30.9	25.6	14.3	26.8	20.5	21.7	33.6	27.7	24.2	31.9	28.0	17.9	29.5	23.7
2	2012	20.3	30.9	25.6	14.3	26.5	20.4	21.7	33.9	27.8	24.3	32.2	28.3	17.5	29.1	23.3
3	2013	20.5	30.8	25.6	14.9	27.0	21.0	22.0	34.0	28.0	24.2	31.8	28.0	17.9	28.8	23.4
4	2014	20.5	30.9	25.7	14.8	26.3	20.6	21.7	33.6	27.6	24.5	32.6	28.6	18.0	29.1	23.5
5	2015	20.8	31.1	25.9	15.1	27.0	21.1	21.9	33.3	27.6	24.4	32.5	28.4	18.5	29.7	24.1
6	2016	20.9	31.5	26.2	15.6	28.1	21.8	22.8	34.5	28.7	24.4	32.3	28.3	17.8	29.9	23.8
7	2017	20.8	31.3	26.0	15.1	27.7	21.4	22.3	34.1	28.2	24.4	32.4	28.4	18.2	29.5	23.8
8	2018	20.6	31.2	25.9	14.8	27.7	21.3	22.2	34.1	28.2	24.3	32.2	28.3	17.8	29.4	23.6
9	2019	20.8	30.9	25.8	14.6	26.8	20.7	22.1	33.9	28.0	24.7	32.5	28.6	18.6	28.4	23.5
10	2020	20.8	30.8	25.8	15.1	26.5	20.8	22.0	33.2	27.6	24.6	32.3	28.5	18.3	29.3	23.8
11	2021	20.9	31.0	25.9	15.4	27.5	21.4	22.1	33.8	28.0	24.5	32.2	28.4	18.5	28.8	23.7
12	2022	20.9	31.1	26.0	15.0	26.2	20.6	22.9	34.5	28.7	24.5	32.2	28.4	18.2	29.3	23.8
	Total	**248**	**372**	**310**	**179**	**324**	**252**	**265**	**407**	**336**	**293**	**387**	**340**	**217**	**351**	**284**
	CAGR	**-83.7**	**-76.7**	**-80.2**	**-88.0**	**-80.1**	**-84.0**	**-82.3**	**-74.3**	**-78.3**	**-81.2**	**-75.8**	**-78.5**	**-85.7**	**-77.9**	**-81.8**
	Mean	**20.7**	**31.0**	**25.8**	**14.9**	**27.0**	**21.0**	**22.1**	**33.9**	**28.0**	**24.4**	**32.3**	**28.3**	**18.1**	**29.2**	**23.7**
	SD	**0.2**	**0.2**	**0.2**	**0.4**	**0.6**	**0.4**	**0.4**	**0.4**	**0.4**	**0.2**	**0.2**	**0.2**	**0.3**	**0.4**	**0.2**
	CV	**1.0**	**0.7**	**0.7**	**2.6**	**2.3**	**2.1**	**1.7**	**1.2**	**1.3**	**0.6**	**0.7**	**0.6**	**1.8**	**1.4**	**0.9**

Source: Environment statistics. I, National Statistical Office Ministry of Statistics and Programme Implementation, GOI



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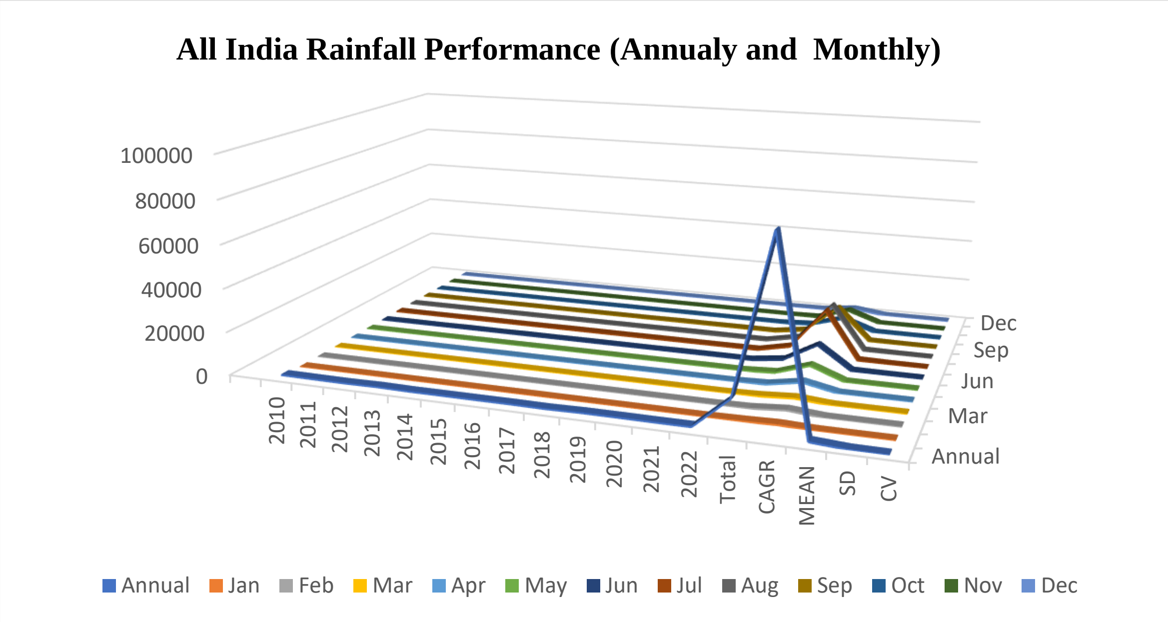
Source- Computed by the author in Excel.

The above table and graph illustrate information about the annual and seasonal atmosphere temperatures, climate, and weather. The monthly minimum (Min), maximum (Max), and mean temperatures for each season (Jan-Feb, Mar-May, Jun-Sep, Oct-Dec) data appear to show yearly and seasonal temperature fluctuations over 12 years. Each category's total, mean, standard deviation (SD), coefficient of variation (CV), and compound annual growth rate (CAGR) are also shown in the table. Trends in Annual Temperature: Throughout the 12 years, the mean annual temperatures range from 25.62°C to 26.2°C.With a mean CAGR of almost -80.16 and an overall mean yearly temperature of 310.04°C, the data suggests a declining trend in temperature over time. Variations in Seasonal Temperature: Seasonal temperature information is provided by the data for every year. Typically, the highest temperatures are June through September (Jun-Sep), while the lowest is January through February (Jan-Feb). Trends and Variability: The variability and relative variability of the data are measured by the standard deviation (SD) and coefficient of variation (CV), respectively. As might be expected given the summer, the CV values show a moderate to high-temperature variability, particularly for June through September. Adverse Effect: Further context or information would be necessary to comprehend the detrimental effects fully. Ecosystems, agriculture, and human health can feel the harmful consequences of temperature. For example, if temperatures are consistently trending lower, this could affect crop growth patterns and necessitate alterations to agricultural practices. General Trends in Climate: Long-term trends are revealed by the CAGR numbers. Negative CAGR numbers indicate a trend toward a drop in temperature over time. It is essential to keep an eye on these trends to comprehend the patterns of climate change and make well-informed judgments about resource management and environmental legislation.

Table 2: All India Heavy Rainfall Performance (Annually and Monthly)

Sr.no	Year	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2010	1213.3	7	16	14	39	73.8	138.1	300.5	274.7	197.4	69	61.5	22.7
2	2011	1116	6.8	25.8	22.4	41.1	53.1	183.6	246.1	284.9	186.7	38.1	20.1	7.6
3	2012	1054.3	26.5	12.7	11.3	47.5	31.7	117.6	250.3	262.3	193.4	58.6	30.7	11.7
4	2013	1242.6	11.3	40.1	15.7	30.3	57.8	219.8	310.1	254.9	152.6	129.3	14	6.7
5	2014	1044.7	19.3	27.4	36.1	22.1	72.9	95.2	261.1	237.4	187.9	60.1	14.4	10.7
6	2015	1085	17.2	20.8	61.4	68.8	53.4	189	240.8	204.2	131.8	42.3	39.9	15.4
7	2016	1083.1	7.8	10.1	30.8	31.4	68.1	147.6	309.2	239.6	168	54.5	7.7	8.4
8	2017	1127.1	26.9	12.4	29	44.3	56.1	172.5	290.5	229.6	153.3	81.5	14.7	16.2
9	2018	1020.8	2.9	12.7	16.5	39.3	64.6	155.7	274.1	240.2	132.7	35.6	21	14.7
10	2019	1288.8	18.5	33.1	18.7	31.5	51.3	113.5	298.8	299.9	259.5	110.1	31.6	19.2
11	2020	1289.6	28.3	12.11	44.7	42.7	71.8	195.6	257.1	327.8	178	78.3	29.2	17
12	2021	1236.4	28.3	7.6	16.7	31.1	107.8	182.4	266.2	196.3	229.6	100.8	56.5	20.5
13	2022	1257	39	19	9	38	83	152	327	264	181	112	19	14
	Total	**15059**	**240**	**250**	**326**	**507**	**846**	**2063**	**3632**	**3316**	**2352**	**970**	**360**	**184**
	CAGR	**84918**	**582**	**1381**	**1255**	**3251**	**5916**	**10742**	**22496**	**20786**	**15220**	**5450**	**5313**	**1992**
	MEAN	**1158**	**18**	**19**	**25**	**39**	**65**	**159**	**279**	**255**	**181**	**75**	**28**	**14**
	SD	**99**	**11**	**10**	**15**	**11**	**18**	**36**	**28**	**37**	**36**	**31**	**16**	**5**
	CV	**9**	**59**	**51**	**60**	**29**	**28**	**23**	**10**	**14**	**20**	**41**	**60**	**35**

Source: Environment statistics. I, National Statistical Office Ministry of Statistics and Programme Implementation, GOI



Source- Computed by the author in Excel.

The above table chart illustrates information about All India Rainfall performance (Annual and monthly). Significant yearly differences exist in the All India Rainfall statistics from 2010 to 2022. Reduced precipitation in some years (2010, 2011, and 2018) raises the possibility of water scarcity and problems for agriculture. On the other hand, years with more significant rainfall (like 2013, 2019, and 2020) could cause flooding and soil erosion. Extreme oscillations are indicated by the overall CAGR of 84918.3, which highlights the necessity of adaptive water management. With an average yearly precipitation of 1158.36 mm, the data shows moderate levels of precipitation. Water scarcity in years with little rainfall and flooding threats in years with excessive rainfall are adverse effects that call for resilient infrastructure and adaptive agricultural methods.

Circular Economy in Agriculture

The 'Linear Economy' is comprised of the traditional 'take-make-use-dispose' model of production and consumption, which needs to be reworked for agricultural production to keep pace with the world's projected population growth and the resultant increased demand for food and other materials (**Edita Baltrėnaitė-Gedienė, 2023**). A circular economy is one pathway towards more sustainable futures. This idea involves a shift from Current debates on limited natural resources, growing populations, and climate, which change, increasingly emphasise the need for the linear 'take-make-consume-dispose' logic to a circular system based on recycling and reusing products, components, and materials while reducing waste to a minimum. **(Klein, 2022).** The circular economy is vital to agriculture since it may lower costs, boost productivity, and reduce waste for farmers and food producers. Farmers that implement circular techniques can utilise materials that would otherwise go to waste and lessen their dependency on outside inputs like insecticides and fertilisers. Circular economies are essential to sustainable production and consumption **(Klein, 2022).**

Here are some positive aspects of the Indian scenario of circular economy impact on agriculture: Resource Efficiency

- **Water use**: Track water consumption per unit of agricultural output (e.g., litres per kilogram of crops). A decrease indicates improved water efficiency.
- **Energy consumption**: Monitor energy use for farming operations (e.g., kWh per hectare). A decline suggests better energy management.
- **Nutrient use efficiency**: Measure the crop yield ratio to fertiliser applied. Higher ratios signify improved nutrient management and reduced environmental impact.

Waste Reduction and Circularity

- **Food waste**: Track the trash generated throughout the agricultural supply chain. Lower levels indicate effective food waste reduction strategies
- **Organic waste recycling**: Monitor the percentage of organic waste (e.g., crop residues, manure) recycled for composting or biogas production. Higher rates showcase efficient waste utilisation.
- **Packaging materials**: Assess the use of reusable or biodegradable packaging for agricultural products. Increased adoption signifies reduced waste generation. Hence, the following tables show the State Solar Photovoltaic (SPV) System in Maharashtra:

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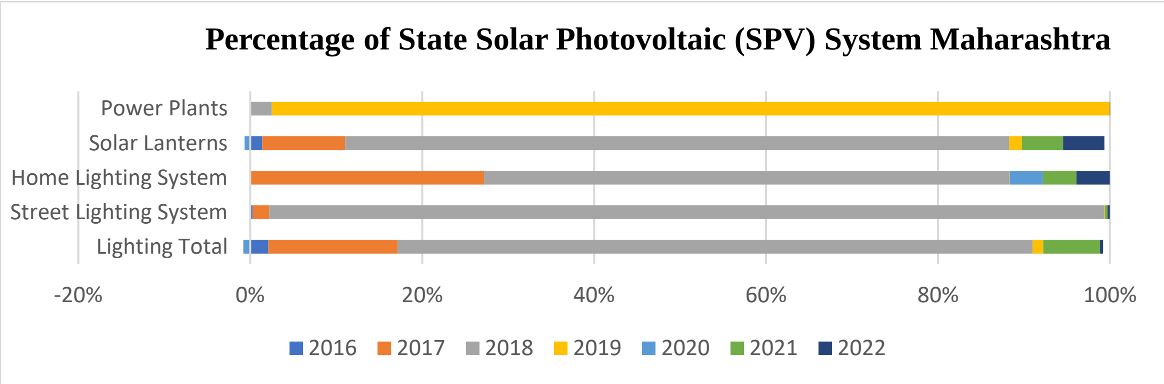
Table 3: Production, Trade, and Consumption Of Energy Decentralised/off-grid renewable energy systems devices by State Solar Photovoltaic (SPV) System in Maharashtra

Sr.no	Year	Lighting Total	Street Lighting System	Home Lighting System	Solar Lanterns	Power Plants
1	2016	0.8	0.1	0	0.7	3857.7
2	2017	0.826	0.1042	0.03497	0.68683	3857.7
3	2018	2.53214	0.1042	0.03497	2.39297	3857.7
4	2019	2.52	0.1	0.03	2.39	3858
5	2020	2.53214	0.1042	0.03497	2.39297	3857.7
6	2021	2.53214	0.1042	0.03497	2.39297	3858
7	2022	0.13917	0.1042	0.03497	2.39297	3858
	TOTAL	**11.88159**	**0.721**	**0.20485**	**13.34871**	**27004.8**
	MEAN	**1.69737**	**0.103**	**0.029264286**	**1.906958571**	**3857.828571**
	SD	**1.061428975**	**0.00204939**	**0.013036587**	**0.829017509**	**0.160356745**
	CAGR	**-99.985503**	**-99.913167**	0	**-99.715123**	**-99.916660**
	CV	**62.533742**	**1.989699**	**44.547770**	**43.473284**	**0.004157**

Source: EPWRF India time series



Source- Computed by the author in Excel.

The above table and chart illustrate information about 2016 to 2022; the table offers data on many areas of solar energy consumption, such as Lighting Total, Street Lighting Systems, Home Lighting Systems, Solar Lanterns, and Power Plants. The data interpretation is as follows, emphasising the benefits of solar energy: Utilization of Solar Energy Overall: The total amount of solar energy used, including power plants, solar lanterns, street lighting systems, and house lighting systems, is shown in the "Lighting Total" column. Benefits of Solar Energy: rising tendency: From 0.8 in 2016 to 2.53214 in 2021, the overall solar energy utilisation demonstrates a rising tendency over time. This suggests that more and more uses of solar energy are being made. Diversification of Use: The table divides the use of solar energy into several groups, including power plants, street lighting, residential lighting, and solar lanterns. This diversity implies that solar energy is used in several industries, promoting sustainability and energy efficiency. Power Plant Consistency: The region's solar energy supply is reliable and substantial, as seen by the continuously vital contribution from solar power plants. Benefits of Solar Energy rising tendency: From 0.8 in 2016 to 2.53214 in 2021, the overall solar energy utilisation demonstrates a rising tendency over time. This suggests that more and more uses of solar energy are being made. Diversification of Use: The table divides the use of solar energy into several groups, including power plants, street lighting, residential lighting, and solar lanterns. This diversity implies that solar energy is used in several industries, promoting sustainability and energy efficiency. Power Plant Consistency: The region's solar energy supply is reliable and substantial, as seen by the continuously vital contribution from solar power plants.

Table 4: Land use area under organic farming in Maharashtra

Sr.no	Year	Total Area (cultivated + wild)	Area-cultivated under certification processes	Certified cultivated organic area	conservation cultivated area	Wild Area
1	2013-14	138335.1	135835.1	85536.66	50298.44	2500
2	2018-19	261571.74	250934.33	150897.137	92837.193	10637.41
3	2019-20	293135.19	282496.32	205216.28	77280.193	10638.87
4	2020-21	371798.28	371722.62	219659.41	152063.21	75.66
	TOTAL	**1064840.31**	**1040988.37**	**661309.487**	**372479.036**	**23851.94**

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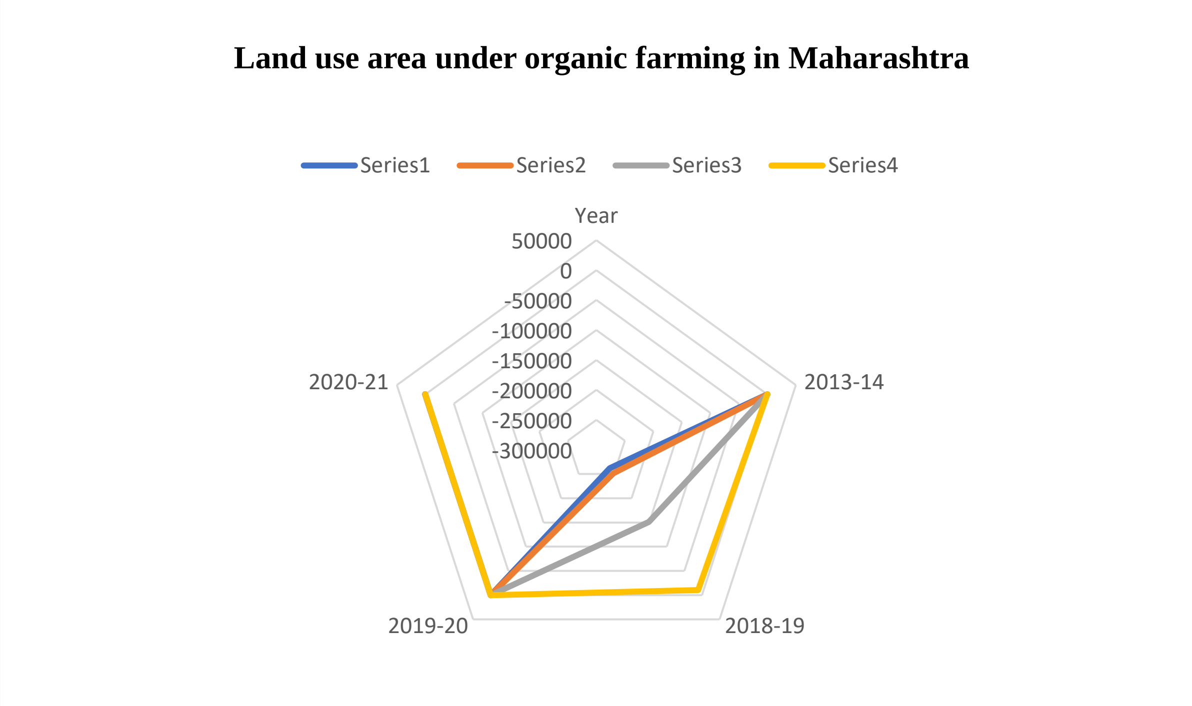
	CAGR	**-99.7760279**	**-99.7719522**	**-99.7859987**	**-99.7480650**	**-99.9975**
	MEAN	**266210.0775**	**260247.0925**	**165327.3718**	**93119.759**	**5962.985**
	SD	**97034.96661**	**97445.528**	**60876.60946**	**43046.36056**	**5488.382**
	CV	**36.45052341**	**37.44346462**	**36.82185764**	**46.2268814**	**92.04085**

Source: EPWRF India time series



Source- Computed by the author in Excel.

The table and chart illustrate the information about land use areas in Maharashtra used for organic farming in the following years: 2013–14, 2018–19, 2019–20, and 2020–21. The overall area (cultivated + wild), the area developed under certification procedures, the certified organic developed area, the conservation developed area, and the wild area for each year are also included. For every category, calculations are also made for the Total, Mean, Standard Deviation (SD), Coefficient of Variation (CV), and Compound Annual Growth Rate (CAGR). Advantages of Organic Farming: Certified Cultivated Organic Area: Between 2013–14 and 2020–21, there is a notable rise in the certified cultivated organic area. This suggests that organic farming methods are becoming increasingly popular in Maharashtra. Conservation-Cultivated Area: There is an increasing tendency in the conservation-developed area to offer sustainable and environmentally friendly farming practices. Over time, there has been a rise in the overall area under organic farming, indicating a growing interest in sustainable agricultural methods. CAGR: The negative CAGR figures show a drop in the development rates of various areas. However, it is crucial to remember that these percentages may be skewed because of the already sizable territories involved. The absolute values remain highly significant despite the negative values suggesting a potential slowdown in the rate of organic farming expansion.

Mean and SD: The standard deviation sheds light on the data's variability, while the mean values provide an average metric. Higher standard deviations suggest more significant data variability. The coefficient of variation, or CV, is a proportional measurement of variability given as a percentage of the mean. According to the data, organic farming is becoming increasingly popular in Maharashtra, with a growing emphasis on certified organic farming and conservation measures. The absolute values indicate considerable areas under organic cultivation, but the negative CAGR values point to a halt in the growth pace.

MAJOR CONCLUSIONS AND POLICY SUGGESTIONS

Traditional farming practices are severely challenged by climate change, but there is also an exceptional opportunity to use circular agriculture to create a more robust and sustainable system. Circular agriculture principles can provide strategies for mitigation and adaptation when agricultural productivity and resource use are threatened by climate change impacts such as altered precipitation patterns, soil erosion, and extreme weather events. The relationship between circular agriculture and climate change is challenging and rapidly developing. The impact of climate change on circular agricultural practices is complex. There are positive and negative impacts. Climate change is negatively affecting agriculture because weather patterns, warmer temperatures, and heavy rainfall can damage crops and reduce yields, but circular agricultural practices (circular economy) can help make the farm more resilient to the impact of climate change also; circular agrarian practices can help to reduce greenhouse gas emission from agriculture, and the positive side is that generate energy and rainwater harvesting and irrigation system can help to reduce water waste.

REFERENCES

[1] Matysik-Pejas, Renata, et al. "An Assessment of the Spatial Diversification of Agriculture in the Conditions of the Circular Economy in European Union Countries." *Agriculture* 13.12 2023: 2235.

[2] Klein, Oliver, Stefan Nier, and Christine Tamásy. "Circular agri-food economies: business models and practices in the potato industry." *Sustainability Science* 17.6 2022: 2237–2252.

[3] Baltrėnaitė-Gedienė, Edita, Donald Huisingh, and Kim Yrjälä. "Circular Economy Benefit Indicators for Using Biochar in Regenerative Agriculture." (2023).

[4] Kamble, P. S. "Impact of climate change on rural development of India." *North Asian International Research Journal of Social Science & Humanities* 2 2016: 3–18.

[5] Zoryna, Tatsiana, et al. "Circular economy in agriculture as a vector for energy security strengthening." *BIO Web of Conferences*. Vol. 52. EDP Sciences, 2022.

[6] Vijai, C., Wisetsri Worakamol, and M. Elayaraja. "Climate change and its impact on agriculture."

[7] Kar, Saibal, and Nimai Das. "Climate change, agricultural production, and poverty in India." *Poverty Reduction Policies and Practices in Developing Asia* (2015): 55.

[8] Polara, Amit M., et al. "Novel Approaches in Agronomy."

[9] Enaime, Ghizlane, Marc Wichern, and Manfred Lübken. "Contribution of biochar application to the promotion of circular economy in agriculture." *Frontiers in Agronomy* 5 (2023): 1214012.

[10] Gupta, Aman, et al. "Effects of climate change on agriculture." *Food and Agriculture Spectrum Journal* 1.02 2020: 103–107.

[11] Romero-Perdomo, Felipe, et al. "Research trends on climate change and circular economy from a knowledge mapping perspective." *Sustainability* 14.1 2022: 521.

[12] Dash, S. K., and J. C. R. Hunt. "Variability of climate change in India." *Current Science* 2007: 782–788.

[13] De Wit, Marc, et al. "The Circularity Gap Report: An analysis of the circular state of the global economy" 2018 .1-36.

[14] https://www.ellenmacarthurfoundation.org

[15] https://epwrfits-in-unishivaji.knimbus.com