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# Impact Of Climatic Changes On The Income Disparities Among The Tea Labours-A Case Study Of Ooty Taluk, The Nilgiris

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***Abstract***
*Climate change, triggered by global warming, has been identified as a major challenge across the globe. In this context, the entire globe has experienced a striking surge in changing climate that is projected to increase at a significant pace in the future, with an unforeseen influence on agriculture, including that of tea. Climate change is one of the most pressing issues of our time, with far-reaching consequences for the environment, human health, and the economy. The tea industry, which is a significant source of employment and income for millions of people worldwide, is particularly vulnerable to the impacts of climate change. Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events are altering the suitability of tea-growing regions, affecting tea yields, and impacting the livelihoods of tea laborers. Tea laborers, who are often among the most marginalized and vulnerable members of society, are facing significant challenges in adapting to these changes. The data collected from 105 sample respondents from Ooty taluk, Nilgiris District. Percentages, Multiple Correlation, Regression and ANOVA, techniques are used by the researcher to analyze the data.*

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## I. Introduction

Climate change, triggered by global warming, has been identified as a major challenge across the globe. In this context, the entire globe has experienced a striking surge in changing climate that is projected to increase at a significant pace in the future, with an unforeseen influence on agriculture, including that of tea. Climate change is defined as a change in the statistical properties, including averages, variability, and extremes, of the climate system that persists for several decades or longer. The future climate will lead to an increase in adverse impacts across the globe.

Climate change is one of the most pressing issues of our time, with far-reaching consequences for the environment, human health, and the economy. The tea industry, which is a significant source of employment and income for millions of people worldwide, is particularly vulnerable to the impacts of climate change.

Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events are altering the suitability of tea-growing regions, affecting tea yields, and impacting the livelihoods of tea laborers. Tea laborers, who are often among the most marginalized and vulnerable members of society, are facing significant challenges in adapting to these changes.

As a versatile sector that has socio-cultural and economic importance, the aforementioned topics should be given high significance in future avenues of the tea sector. Such systematic reviews can be exploited as useful tools to initiate scientific studies in the future. Furthermore, an exploration of tea's potential response to the current and future climate may be a successful strategy to form policies and decisions for the future reinforcement of climate-resilient tea systems. Filling the knowledge gap in the existing literature and raising awareness of the holistic picture of how climate change impacts the tea yield, quality, and climate suitability are crucial in order to achieve sustainable tea production, embracing multidisciplinary mitigation and adaptation approaches in the future.

**Impact of Climatic Changes in Nilgiris Tea Industry**

Climate change is significantly impacting tea production in the Nilgiris, a region renowned for its tea plantations. Rising temperatures, changing rainfall patterns, and increased frequency of extreme weather events are altering the delicate ecosystem required for tea cultivation.

The Nilgiris district in Tamil Nadu, India, is home to numerous tea factories, with several sources

mentioning the presence of various tea estates and factories.

Some notable tea factories in the Nilgiris include the INDCO Tea Factories, which comprise multiple factories such as the Bitherkad INDCO Tea Factory, Nanjanad INDCO Tea Factory, and Kunda INDCO Tea Factory, among others [1]. Additionally, there are modernized cooperative tea factories in the district, which were inaugurated recently

**Objective:**

1.To study the Socio Economic Condition of the Respondents.
2.To study the Impact of Climate changes on Income Disparities among the Respondents.
3.To study find out the Impact Climate Change on Health Status of the Respondents.

**Hypothesis:**

1.There is no significance relation between age and Monthly income of the Respondent.
2.There is no significance difference between off season and on season income.
3.There is no impact on Age , Education and type of Tea Leaf on monthly income of the Respondent

## II. Review Of Literature

**In Sarkar's (2013)** research, the focus was on the living conditions of workers in the Jalpaiguri district during colonial India. The study revealed that the workers on the tea estate were experiencing feelings of uncertainty, despair, and extreme distress due to the oppressive policies implemented by the tea planters. During that time, the workers' conditions were significantly worse than they are now. They experienced severe scarcity, ill health, exploitation, physical abuse, and oppression, as they had no means to protest or speak out against the brutal plantation owners. The study revealed that during the past 150 years, the government has neglected the working population in the Jalpaiguri district in terms of development.

**Raja, M., & Mythili, C. (2019).** Tea industry in India is considered to be the largest employer of men and women as well as the oldest in the plantation sector. It employs about 12 lakhs casual, seasonal and permanent workers throughout the sector. Most of the workers in the tea sector especially in tea estates are women. It is estimated that about 80 per cent of the women workers are tea puckers. The role of women in tea sector cannot be ignored. Apart from doing the crucial house hold works, they are also actively participating in tea sector to support the monthly income of the family. Hence, the researcher has taken up the topic to analyze the sustainable livelihood and economic status of workers in the tea industry with special reference to Nilgiris district.

**Shahadat, K., & Uddin, S. (2022).** This article examines labor controls in traditional tea plantations in Bangladesh. This study finds how social and economic exclusion through discriminatory labour laws and labour–manager relations rooted in the ‘coolie’ system have built a captive workforce separated from the mainstream workforce. This ultimately produces and reproduces slavery–laden labour controls. An opaque but punitive incentive system, sunset-sunrise working hours, maximum engagement, and the restrictions of promotion to managerial posts are constant reminders of the historically rooted indentured labour system. This article contributes to understanding modern slavery in an organizational context and the obstacles that prevent ‘free’ labourers from walking away from exploitative conditions

**Lou, W., Sun, S., Wu, L., & Sun, K. (2015)** As the local climate has changed, the beginning dates of tea bud and leaf plucking of this cultivar in all five counties studied has advanced significantly by −1.28 to −0.88 days/decade, with no significant change in the risk of frost. The main tea-producing stages in the tea production cycle include the plucking periods for superfine, grade 1, and grade 2buds and leaves. Among the five bud and leaf grades, the economic output of the plucking periods for superfine and grade 1 decreased significantly, that for grade 2 showed no significant change, and those for grades 3 and 4 increased significantly. The economic output of large-area tea plantations employing an average of 45 workers per hectare and producing superfine to grade 2 buds and leaves were significantly reduced by 6,745–8,829 yuan/decade/ha, depending on the county.

**Selection Of The Sample Households**

The data was collected structured interview schedule from 105 respondents by using the systematic random sampling method. In the first stage, Nilgiris district was selected. From the district ooty taluk was selected. For this study randomly 105 tea labors was selected as sample in ooty

## III. Results And Discussions

**Table-1-Socio-Economic Status Of The Respondents**

| Name of the Variable | Classification of the Variable | No of Respondents | percentage |
|---|---|---|---|
| Age | 20-30 | 18 | 17.1 |
| | 31-40 | 30 | 28.6 |
| | 41-50 | 43 | 41.0 |
| | Above50 | 14 | 13.0 |
| | **Total** | **105** | **100.0** |
| Gender | Male | 45 | 42.9 |
| | Female | 60 | 57.1 |
| | **Total** | **105** | **100** |
| Education | Illiterate | 16 | 15.2 |
| | Primary | 62 | 59.0 |
| | Middle School | 20 | 19.0 |
| | Higher secondary | 7 | 6.7 |
| | **Total** | **105** | **100.0** |
| Marital Status | Single | 12 | 11.4 |
| | Married | 77 | 73.3 |
| | Windowed | 13 | 12.4 |
| | Divorced | 3 | 2.9 |
| | **Total** | **105** | **100.0** |

**Source: Field Survey 2025**

A majority 41 Percentage of the respondents are belongs to 41 to 50 age group. And 28.6 percentage of the respondents are the age group of 31 to 40. And remaining 17.1 percentage of the respondents are 20 to 30 age group.

. A majority of 59.0 percent respondent are in the primary, 19.0 percent of the respondents are Middle school 15.2 percent of the respondents are illiterate, 6.7 percent of the respondents are higher secondary.

A majority of 73.3 percentage respondents of the married. And remaining 12.4 percentage of the respondents are windowed. 11.4 percentages of the respondents are single. 2.9 percent respondent of the divorced

**Table-2- Economic Status of the Respondents**

| **Name of the Variable** | **Classification of the Variable** | **No of Respondents** | **percentage** |
|---|---|---|---|
| Nature of Employment | Permanent tea labor | 41 | 39.0 |
| | Seasonal tea labor | 36 | 34.3 |
| | Casual | 24 | 22.9 |
| | Temporary worker | 3 | 2.9 |
| | Other | 1 | 1.0 |
| | **Total** | **105** | **100.0** |
| Years of Experience | Below 5 | 22 | 21.0 |
| | 5-10 | 23 | 21.9 |
| | 10-15 | 49 | 46.7 |
| | Above 15 | 11 | 10.5 |
| | **Total** | **105** | **100.0** |
| Working hours in Normal Season | 1-3 hours | 5 | 4.7 |
| | 3-4 hours | 12 | **11.4** |
| | 4-5 hours | 24 | **23.5** |
| | Half day | **30** | **28.5** |
| | One day | **34** | **32.3** |
| | **Total** | **105** | **100.0** |
| No .of Kg plucked during Normal season | 30-35 | 39 | 37.1 |
| | 35-40 | 49 | 46.7 |
| | 40-55 | 17 | 16.2 |
| | **Total** | **105** | **100.0** |

**Source: Field Survey 2025**

A Majority 39.0 percentage of the respondents permanent tea labor. And remaining 34.3 percentage of the respondents seasonal tea labor. 22.9 percentage of the respondents of the casual. remaining 2.9 percentage of the respondents temporary worker

A majority 46.7 percentage of the respondents are having 10-15 of w orking experience.. Remaining of 21.9 percentage of the respondents are having 5 -10 of experience. Minimum 10.5 % of the respondents only having more then 15 years of experience. A Majority32 percentage . of respondents are working one full day under normal season .Only Minimum 5 percentage. of workers are doing work only 1 to

3 hours .Because of their illness.

Minimum level of 46.7 percentages of the respondents 35-40. there are plucked and 37.1 percentage of the respondents 30-35.pluking the normal seasons. 16.2 percentage of the respondents are 40-55 there are plucking leaf.

**Table-3-Monthly Income Of The Respondent During Normal Season**

| S.NO | Monthly Income(Rs.1000s) | No.of Respondents | Percentage |
|---|---|---|---|
| 1 | below5000 | 10 | 9.52 |
| 2 | 5000-10000 | 16 | 15.24 |
| 3 | 10,000-15000 | 74 | 70.46 |
| 4 | Above 15,000 | 05 | 4.78 |
| | **Total** | **105** | **100.0** |

**Source: Field Survey 2025**

In the above table Majority 71 percent of the respondents belongs to the income group Rs.10000 to Rs.15000. Only minimum no. of respondents are in the higher income group above Rs. 15,000.

**Table -4-Monthly Income of the Respondent during Snow Season**

| S.NO | MONTHLY INCOME(RS.1000S) | NO.OF RESPONDENTS | PERCENTAGE |
|---|---|---|---|
| 1 | below5000 | 34 | 32.38 |
| 2 | 5000-10000 | 57 | 54.29 |
| 3 | 10,000-15000 | 11 | 10.47 |
| 4 | Above 15,000 | 3 | 2.86 |
| | **Total** | **105** | **100** |

**Source: Field Survey 2025**

Majority 54.29 percentage respondents of the 5000-10000.remaining 32.38 percentage of the respondents. below5000.

**Alternative Hypothesis(H1):** There is significant relationship between type of Tea Leaf Plucked and Monthly Income of the respondent

**Null Hypothesis(H0)** There is No significant relationship between type of Tea Leaf Plucked and Monthly Income of the respondent

**Table-5-Multiple Correlation Between Type Of Tea Leaf Plucked And Income Of On Season And Off Season**

| Correlations | | | | |
|---|---|---|---|---|
| | | Type of tea leaf plucked | Of Season Monthly income | Monthly Income On Season |
| Type of tea leaf plucked | Pearson Correlation | 1 | -.048 | .047 |
| | Sig. (2-tailed) | | .629 | .637 |
| | N | 105 | 105 | 105 |
| Of Season Monthly income | Pearson Correlation | -.048 | 1 | .237* |
| | Sig. (2-tailed) | .629 | | .015 |
| | N | 105 | 105 | 105 |
| Monthly Income On Season | Pearson Correlation | .047 | .237* | 1 |
| | Sig. (2-tailed) | .637 | .015 | |
| | N | 105 | 105 | 105 |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | |

In the above Table The "r" Value is 0.04, it is less than the significant Level. Hence Null Hypothesis rejected and Alternative Hypothesis Accepted. That is There is significant relationship between type of Tea Leaf Plucked and Monthly Income of the respondents

**Hypothesis-II**

**Alternative Hypothesis(H1):** There is a significant impact of Climatic changes on Income and Health Status of the respondents

**Null Hypothesis Hypothesis(H0)**: There is a significant impact of Climatic changes on Income and Health Status of the respondents

**Table-6-Opinion of the Respondents about the Impact of Climatic Changes on Their Income and Health-ANOVA**

| | | Sum Of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Opinion About Shifting To Another Occupation If Tea Labor Becomes Unsustainable | Between Groups | 5.025 | 3 | 1.675 | 4.358 | .006 |
| | Within Groups | 38.823 | 101 | .384 | | |
| | Total | 43.848 | 104 | | | |
| Opinion About Climate Change Impacted The Your Income In The Last 5 Years | Between Groups | 32.118 | 3 | 10.706 | 6.240 | .001 |
| | Within Groups | 173.273 | 101 | 1.716 | | |
| | Total | 205.390 | 104 | | | |
| Opinion About Climate Change Has Influenced Income | Between Groups | 3.406 | 3 | 1.135 | 1.220 | .306 |
| | Within Groups | 93.985 | 101 | .931 | | |
| | Total | 97.390 | 104 | | | |
| Opinion About Climate Change Affected The Number Of Days Working Employed Annually | Between Groups | 29.581 | 3 | 9.860 | 11.818 | .000 |
| | Within Groups | 84.267 | 101 | .834 | | |
| | Total | 113.848 | 104 | | | |
| Opinion About Temperature Fluctuation affected Tea Yield And Consequently Income | Between Groups | 6.176 | 3 | 2.059 | 3.021 | .033 |
| | Within Groups | 68.815 | 101 | .681 | | |
| | Total | 74.990 | 104 | | | |
| Opinion About The Changing Pattern Of Rainfall Affected Your Income | Between Groups | 1.419 | 3 | .473 | .742 | .530 |
| | Within Groups | 64.428 | 101 | .638 | | |
| | Total | 65.848 | 104 | | | |
| | Total | 90.133 | 104 | | | |
| | Total | 148.229 | 104 | | | |

**Source: Field Survey 2025**

According to the above table, Majority of the respondents are also agreed that climatic changes affected their income in a significant level.

**Opinion about shifting to another occupation if tea labor becomes unsustainable** F = 4.358, = 0.006 (Sig. = .006): Significant difference between groups (p = 0.006), indicating that opinions about shifting occupations vary significantly across groups.

**Opinion about climate change impacted the income in the last 5 years** F = 6.240, p = **0.001 (Sig. = .001): Significant difference between groups (p = 0.001), suggesting that opinions about climate change impacts on income vary significantly across groups.**

**Opinion about climate change has influenced income** F = 1.220, p = 0.306 (Sig. = .306): No significant difference between groups (p = 0.306), indicating that opinions about climate change influences on income do not vary significantly across groups.

**Opinion about climate change affected the number of days working employed annually** F = 11.818, p < 0.001 (Sig. = .000): Significant difference between groups (p < 0.001), suggesting that opinions about climate change impacts on working days vary significantly across groups.

**Opinion about temperature fluctuation affected tea yield and consequently income** F = 3.021, p = 0.033 (Sig. = .033): Significant difference between groups (p = 0.033), indicating that opinions about temperature fluctuation impacts on tea yield and income vary significantly across groups.

**Opinion about the changing pattern of rainfall affected income** F = 0.742, p = 0.530 (Sig. = .530): No significant difference between groups (p = 0.530), suggesting that opinions about rainfall pattern impacts on income do not vary significantly across groups.

In summary, the results suggest that opinions about climate change impacts on tea labor, income, and working days vary significantly across groups, while opinions about the future of tea labor, climate change influences on income, and rainfall pattern impacts on income do not vary significantly across groups.

**Suggestions**

This study aims to investigate the impact of climate change on the income of tea laborers In Specifically, the study will examine the relationships between climate- related variables (such as temperature, precipitation, and extreme weather events) and tea laborers' income.

The study will also identify the key climate-related risks and vulnerabilities faced by tea laborers and explore potential adaptation strategies to mitigate these impacts. The findings of this study will contribute to a better understanding of the impacts of climate change on the tea industry and the livelihoods of tea laborers.

The study's results will also inform policy and decision-making at the local, national, and international levels, ultimately supporting the development of effective adaptation strategies to protect the livelihoods of tea laborers and ensure the long-term sustainability of the tea industry. Climate change is having a profound impact on the livelihoods of tea laborers, exacerbating existing vulnerabilities and uncertainties. Rising temperatures, changing rainfall patterns, and increased frequency of extreme weather events are affecting tea yields, quality, and labor demand, ultimately leading to reduced incomes and increased poverty among tea labor households.

The study's findings highlight the need for urgent action to support tea laborers in adapting to climate change. This can be achieved through a combination of measures, including

**1.Participatory Rural Appraisal (PRA):** Use PRA methods to engage with tea laborers and smallholder farmers, and to gather data on their perceptions and experiences of climate change.

**2.Climate modeling:** Use climate modeling techniques to project future changes in temperature and precipitation patterns, and to assess the potential impacts on tea production.

**3.Economic analysis:** Conduct economic analyses to assess the costs and benefits of different adaptation strategies, and to identify potential opportunities for tea companies and policymakers to support climate-resilient tea production

**4.Socio-economic vulnerability:** Evaluate the socio-economic vulnerability of tea labor households, including their exposure to poverty, food insecurity, and other forms of vulnerability.

**5.Adaptation and coping strategies:** Investigate the adaptation and coping strategies used by tea labor households, including their use of climate-resilient agricultural practices, insurance schemes, and other forms of support.

**6.Remote sensing**: Use remote sensing techniques to monitor changes in tea production and climate-related variables, such as temperature and precipitation.

**7.Climate-smart agriculture (CSA) framework**: Apply the CSA framework to assess the climate resilience of tea production systems and identify opportunities for improvement.

**8.Climate-resilient tea production practices**: Promoting sustainable agriculture practices, such as shade management, irrigation systems, and integrated pest management.

**9.Climate information and early warning systems:** Establishing climate information and early warning systems to help tea laborers prepare for and respond to climate-related shocks.

**10. Empowerment and capacity building**: Empowering tea laborers, particularly women, through training and capacity-building programs to enhance their resilience and adaptability.

## IV. Conclusion:

To conclude, the tea plantation industry in India plays a vital role in the agricultural economy, providing employment opportunities to many. However, these workers face many occupational health hazards like chemical exposure, physical strain, and lack of proper safety measures etc. The study's findings also underscore the need for policymakers, tea companies, and other stakeholders to prioritize the welfare of tea laborers in their climate change mitigation and adaptation strategies. By working together, we can help tea laborers build resilient livelihoods and ensure the long-term sustainability of the tea industry.

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