Climate Change and Human Life: An Empirical Study of the Malwa Plateau

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Abstract In the current era, climate change is having profound impacts on various dimensions of human life—health, livelihood, and agricultural productivity—particularly in developing regions. To examine the impact of temperature rise, irregular rainfall, and irregular seasonal events on human life in the Malwa Plateau region of Central India, a survey of 500 families in 10 rural communities across Indore, Mhow, and Dhar districts was conducted between 2022 and 2024. Health record analysis revealed a 35% reduction in income among agriculture-based families, while heat-related diseases increased by 22%. Droughts and floods caused a 15-20% decrease in crop yield, leading to increased malnutrition and migration. Statistical analysis demonstrated the significant role of land use changes and socio-economic inequalities. These findings indicate that climate change is having widespread effects on economic conditions, and underscore the urgent need for health awareness programs and region-specific adaptation strategies.

Keywords: Climate change, human health, agricultural productivity, livelihood insecurity, Malwa Plateau, adaptation strategies, ecosystem

Introduction The Malwa Plateau, a major agriculture-dominated region of Madhya Pradesh, is renowned for its black soil and river-based ecosystems. This region forms the livelihood base for millions of farming families. Global average temperature has increased by 1.1°C over the past decade, and it is estimated that South Asia may experience an additional 1.5°C rise by 2030 (IPCC, 2021). In Madhya Pradesh, this temperature increase is manifesting as irregular monsoons, prolonged droughts, and intense heat waves, which are affecting agriculture, health, and social structures.

The impacts of climate change are multidimensional—from agricultural losses leading to livelihood crises, heat stress causing health risks, and changing seasonal events resulting in increased displacement. Previous research has documented an 8-12% reduction in crop productivity in India (Pathak et al., 2018) and increasing livelihood insecurity among tribal communities (Kumar et al., 2024). However, limited empirical research is available on local contexts like the Malwa Plateau. This study fills this gap, focusing on rural communities in Indore district and surrounding areas, where 70% of the population is directly dependent on agriculture.

This research paper presents original survey data and provides recommendations for sustainable development by measuring the human impacts of climate stresses. By integrating regional data with statistical analysis, this study evaluates the interaction between climate and social factors.

Study Area The study was centered on 10 rural sites on the Malwa Plateau (22°–23°N, 75°–76°E), including agricultural villages in Indore, Mhow, and Dhar districts. Site selection was conducted according to the guidelines of the Madhya Pradesh State Action Plan on Climate Change (MP SAPCC, 2023). The average elevation is 500–550 meters, and long-term annual rainfall is 800–1000 mm, with a 16-18% reduction recorded during the 2022-2024 period (IMD, 2024).

Data Collection Research data was collected between 2022-2024. The survey was based on 500 families (total 2,500 individuals), conducted through structured questionnaires and focus group discussions. Agricultural data recorded changes in crop yield (wheat, soybean) and household income. Health data was obtained from district hospital records, including cases of heat stroke, dengue, and malnutrition. Climate variables (temperature, rainfall) were taken from India Meteorological Department (IMD) stations and local rain gauges. Livelihood insecurity was assessed using the Livelihood Vulnerability Index (LVI) framework (Hahn et al., 2009), which measures sensitivity, exposure, and adaptive capacity.

Statistical Analysis Results were analyzed using linear regression models in R software (version 4.3.1), with climate variables as independent variables and health and income as outcome variables. The statistical significance level was set at $\alpha = 0.05$. Ethical approval was obtained from the local Institutional Review Board (IRB), and informed consent was obtained from all participants.

Results

Changes in Agricultural Productivity Survey data revealed an average 17% reduction in agricultural productivity, statistically linked to the 2023 drought event (linear regression: $\beta = -0.45$, $p < 0.001$). Rain-dependent crops, particularly soybean, recorded a 22% loss, while wheat showed a 12% reduction. Total household income declined by 35%, forcing 28% of families to take loans.

Health Impacts Climate-related health impacts were notable. Heat-related diseases (heat stroke and dehydration) increased by 22%, while vector-borne diseases (dengue) increased by 15% ($\chi^2 = 32.1$, $p < 0.01$). Malnutrition

rates among children increased by 12%, correlated with income loss.

Livelihood Insecurity The Livelihood Vulnerability Index (LVI) score was 0.68, indicating high insecurity. The highest LVI score (0.75) was recorded in Dhar district, reflecting greater vulnerability of marginal farmers and tribal communities.

Disaster Impact In the 2023 flood event, approximately 1.2 lakh hectares (approximately 42% of the total study area) of crops were damaged, forcing 15% of families to migrate to other areas.

Results Statistical modeling confirmed that temperature increase (>2°C) and rainfall reduction explain 58% of the total variation observed in human health and economic loss ($R^2 = 0.58$, $p < 0.001$).

Discussion

Interpretation of Results The obtained results are consistent with global and national trends, but Malwa's intense agricultural dependence makes this crisis more severe. Research in various regions of India shows that the structural vulnerability of rain-based agriculture amplifies the impacts of climate change (Aggarwal et al., 2018). Health impacts, such as heat stress, intensify existing social inequalities, particularly among women, elderly, and Dalit communities.

Trophic Impact of Livelihood Crisis Income reduction has widespread effects at multiple levels: from children's education to family nutrition, which disrupts long-term development prospects. Local factors, such as lack of irrigation facilities, declining groundwater levels, and deteriorating soil quality, amplify climate impacts (CDKN, 2014). In Madhya Pradesh particularly, dependence on agriculture is highest in tribal areas (Kumar et al., 2024), making these communities extremely vulnerable.

Limitations and Future Directions This study is based on three years of data, which may not fully reflect long-term climate trends. Sample size and geographical limitations may constrain generalization of findings. Future research should integrate 10+ years of data, genetic health indices, and climate scenario modeling.

Suggested Policy Recommendations

1. **Agricultural Adaptation:** Investment in drip irrigation systems, climate-tolerant seed varieties (Chakraborty et al., 2022), and mixed farming practices to strengthen the Madhya Pradesh State Action Plan on Climate Change (2023).
2. **Health Infrastructure:** Establishing community health centers in rural areas (Joshi et al., 2020) and awareness programs on climate-related health risks.
3. **Financial Allocation:** 20% increase in budget for climate adaptation.

Community-Based Management: Empowering communities for local resource management, especially in tribal areas.

Ultimately, protection of human life is inextricably linked to environmental conservation, which will lay the foundation for sustainable development.

Conclusion This study demonstrates that climate change is severely affecting human life in the Malwa region in various ways, with declining agricultural productivity, increasing health problems, and growing livelihood insecurity being prominent. Without immediate intervention, these impacts will cause social and economic instability, weakening the region's important agricultural economy.

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