



Beyond climate change: Examining the role of environmental justice, agricultural mechanization, and social expenditures in alleviating rural poverty

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ABSTRACT

Extreme weather events and extreme poverty are two sides of the same coin, with far-reaching consequences for emerging nations like Pakistan. Rural people are more likely to experience poverty and inequality as climate change worsens. This research aspires to close the gap between environmental ethics and justice by investigating how climate change issues contribute to poverty in Pakistan. The study used Robust Least Squares (RLS) regression to analyze the impact of water scarcity, extreme temperatures, and excessive rainfall on rural poverty in Pakistan from 1990Q1 to 2022Q4. Further, the study examines the effect of environmental justice interventions, access to healthcare and education, agricultural value-added and agricultural mechanization on the country's rural poverty. Results reveal that climate change contributes to rural poverty in Pakistan, while environmental justice initiatives, healthcare access, and agricultural automation alleviate poverty incidence. The Impulse Response Function (IRF) estimates suggested that rural poverty will be exacerbated over the next decade by water scarcity, high temperatures, and low agricultural value added but alleviated by excessive rainfall, environmental justice intervention, healthcare access, and agricultural mechanization. According to Variance Decomposition Analysis (VDA) projections, agricultural value added will substantially impact rural poverty by 2032, increasing it by 11.431%. Addressing these problems requires policymakers to prioritize the interests of the most marginalized groups by fostering fair results. Policies should cut GHG emissions and encourage sustainable development to combat climate change. Modernizing farming techniques and expanding access to healthcare are also necessary for increasing efficiency and production. It is essential to execute environmental justice interventions so that all communities have access to environmental resources and protections equitably. Promoting equitable outcomes and reducing poverty in Pakistan's climate change context may be achieved by closing the gap between environmental ethics and justice.

1. Introduction

The intersection between poverty and climate change in Pakistan necessitates attention to environmental ethics and justice issues.

Environmental ethics concerns the moral principles that govern our interactions with nature. Environmental justice ensures that all people and communities have equal access to environmental resources, not disproportionately harmed by environmental damages [1–4]. Existing

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socioeconomic disparities and the gap between the affluent and people with low incomes are expected to be exacerbated by the effects of climate change in Pakistan [5]. Because of their potential inability to prepare for and recover from climate-related catastrophes, low-income communities are especially at risk from climate change's effects [6]. This leads to moral concerns regarding who should lead in mitigating climate change and protecting society's most disadvantaged individuals [7,8]. From an ethical standpoint, those more responsible for GHG emissions and climate change should be more responsible for resolving its repercussions [9,10]. In light of this, developed nations, which have historically contributed the most to GHG emissions, should aid developing nations, such as Pakistan, in their efforts to adapt to the effects of climate change and advance sustainable development [11].

When considering the effects of climate change from a justice viewpoint, it is essential to ensure that society's most vulnerable members are not unfairly affected. Providing clean water and sanitation, improving housing conditions, and helping small-scale farmers adapt to changing environmental conditions are all examples of interventions that would help meet the needs of the most vulnerable members of society [12,13]. Looking at how poverty and climate change are connected in Pakistan requires considering environmental ethics and justice [14, 15]. Sustainable and equitable development can be achieved for all people if we consider the moral values that inform our interactions with the natural world and if we seek to ensure that all people and communities have access to environmental resources [16,17]. One of the most significant problems of our day is climate change, which affects every country, rich and destitute. Countries like Pakistan, which have few resources and a high poverty rate, would feel the effects of climate change the hardest [18,19]. Climate change, economic inequality, quality education, and lack of health facilities are key variables in poverty; they must be examined. Pakistan is very sensitive to climate change. Floods, droughts, and other natural calamities have historically affected the country's population [20,21]. Pakistan has 20% poverty, making it one of the most impoverished countries [22,23]. This research examines Pakistan's poverty, agricultural income, education, and health from 1990Q1 through 2022Q4. Income, education, and health will moderate climate change's effects on poverty. This research illuminates poverty and climate change, aiding Pakistani sustainable development. This research may also illuminate a significant concern for other emerging countries.

This research was inspired by a desire to learn more about environmental ethics and justice in light of Pakistan's current poverty and climate change crises. We want to learn more about the moral implications of climate change and poverty in Pakistan and develop plans to advance environmental justice via poverty alleviation and climate resilience programs. This research may aid in formulating policies and interventions that promote sustainable development and fair results by shedding light on the moral implications of climate change and poverty in Pakistan. The study aims to accomplish the aforementioned by addressing the following research questions:

- I What moral implications do climate change and poverty in Pakistan have?
- II What role may policies and initiatives addressing climate change and poverty in Pakistan play in advancing environmental justice? And
- III In light of poverty and climate change in Pakistan, what possibilities and obstacles exist for advancing environmental justice?

The following goals direct our research to address these questions:

- I To research relevant literature and policy documents to investigate the moral implications of climate change and poverty in Pakistan.

- II To determine how environmental justice might be integrated into Pakistan's poverty alleviation and climate change adaptation initiatives.
- III To analyze Pakistan's environmental justice issues and potential in the context of poverty and climate change.

Policymakers and other stakeholders in Pakistan who care about lowering poverty and boosting climate resilience would benefit greatly from this study's results. This research can influence policies and actions that promote sustainable development and equitable results by recognizing the ethical implications of climate change and poverty in Pakistan and methods for achieving environmental justice. This research has the potential to add to the growing body of literature on environmental ethics and justice, shedding light on a topic that may be useful to other developing nations. Overall, this research hopes to improve policies and actions that promote sustainable development and equitable results in Pakistan by providing a more nuanced knowledge of the ethical elements of climate change and poverty in that country.

2. Literature review

The literature review examines three primary factors for attaining sustainable and equitable development in Pakistan. First, it addresses the connections between climate change, food insecurity, and poverty. The analysis highlights the critical need to address climate hazards and food insecurity to reduce poverty in at-risk populations by examining the intricate connections between these issues. The second focus of the study is on the function of agricultural mechanization in alleviating rural poverty. Modern agricultural methods can potentially improve agricultural output and the lives of rural populations, and this assessment emphasizes the need to invest in cutting-edge technology to this end. Finally, this review investigates how environmental justice measures could promote long-term viability and social fairness. The study highlights the importance of environmental justice and fair allocation of resources in promoting sustainable and inclusive development by analyzing the social and environmental implications of development policies and initiatives.

2.1. Climate change, agriculture, and poverty incidence in developing countries

The effects of climate change on ecosystems, economies, and societies are widespread and far-reaching, making it one of the most pressing global concerns of our day. The research of Pachauri [24] sheds light on how innovative farming techniques might help alleviate rural poverty in emerging nations. The research, nevertheless, highlights the trade-off between advancement and increased energy needs, which is particularly relevant in energy-scarce rural areas. The unique idea of "investment poverty" is introduced by Reardon & Vosti [25], providing a prism to examine the complex relationship between economic deprivation and the dynamics of the natural world. They analyze the data in detail to show how different assets and environments may affect poverty levels differently, underscoring the need to tailor policy responses to local conditions. An insightful look at the effects of climate change on vulnerable communities in developing nations, as stated by Sanchez [26]. Research centers play a crucial role in leading innovative-driven adaptation and mitigation efforts, and this study argues for synergistic linkages among multinational research projects. Hertel and Rosch's [27] viewpoint is crucial because it highlights the connection between climate change and poverty, which should be discussed more. Their research highlights the importance of considering agriculture's role in mediating climate effects and providing a possible remedy when formulating policy frameworks for sustainable development in the global south.

Leichenko & Silva [28] explore the complex relationship between climate change and poverty, highlighting the need to consider this