

Climate Change and Rural Development in China: Adaptation, Strategies and their Effectiveness


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Abstract

Global warming and climate change are our world's most pressing issues today. These phenomena have profound implications for rural development in China, a country with a large rural population and significant agricultural production. This study utilized qualitative research methods to explore the impact of climate change on rural development in China, focusing on agriculture and water resources. The results showed that climate change has already begun to affect crop yields and water availability, which could significantly affect rural communities' livelihoods and food security. Furthermore, the study found that the Chinese government has been implementing various policies and programs to mitigate climate change's impact on rural development. These initiatives include investing in water conservation and irrigation infrastructure and promoting adopting climate-resilient agricultural practices. While these efforts are commendable, they face significant challenges, including insufficient funding and the need for more effective implementation. In conclusion, this study highlights the critical role of climate change in shaping rural development in China. It underscores the importance of continuing research and implementing effective policies to mitigate its impact and foster sustainable rural development.

Keywords: Climate Change, Rural Development, Government Policies, China

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INTRODUCTION

The scientific community widely recognizes climate change as an indisputable fact and has profound implications for the environment, human societies, and the economy. The rise in surface temperatures during the past century indicates the far-reaching impact of climate change on biological and physical systems. The ramifications of climate change are extensive, with consequences such as sea-level rise, shifts in climatic zones, and changes in precipitation patterns. The increase in the frequency and severity of extreme weather events is also a significant threat. While the exact magnitude, rate, and geographic patterns of climate change remain uncertain, there is a consensus that its effects will significantly impact future generations. In addition, climate change has severe social and economic implications, particularly for vulnerable communities. The risks to food security and agricultural production are already evident, with droughts, floods, and changes in precipitation patterns leading to crop failure, loss of livestock, and soil degradation. These phenomena affect local communities' livelihoods and global food production and distribution.

Climate change has been a topic of discussion in scientific and political circles for several decades. Recognizing its far-reaching consequences and the need for action, scientists and policymakers have called for a coordinated and proactive approach to tackle the problem. Countries across the globe have started taking measures to reduce greenhouse gas emissions and develop clean energy alternatives. However, the international response has been slow and inadequate to tackle the scale and complexity of the challenge posed by climate change. The need for a more coordinated and comprehensive approach has been highlighted by the scientific community and international bodies such as the United Nations Framework Convention on Climate Change (UNFCCC). This approach should involve not only the reduction of greenhouse gas emissions but also the development and implementation of adaptation measures to cope with the impacts of climate change. Such an approach would require global cooperation and shared responsibility to achieve sustainable development goals.

The consequences of inaction on climate change are enormous and have the potential to impact the environment and human society in irreversible ways. Rising sea levels, more frequent extreme weather events, and other climate-induced natural disasters could result in the displacement of millions of people, the destruction of critical infrastructure, and widespread economic disruption. Such consequences are not only a threat to current generations but also to future generations, who will be forced to bear the burden of our inaction. Thus, the need for coordinated action to address the impacts of climate change has never been more urgent.

The effects of climate change on agriculture are expected to be significant, with a significant impact on China's agricultural sector. The severity of these consequences is still being debated, but there is widespread agreement that climate change will significantly impact China's agricultural production. Because of the size of China's agricultural production and its importance in global trade, the impact of climate change on the country is of international concern (Wang, 2010). Under the worst-case scenario, the Intergovernmental Panel on Climate Change (IPCC) has identified a range of potential consequences, including reductions in rain-fed rice, wheat, and maize yields of 20 to 36 percent over the next 20 to 80 years (IPCC, 2007; Xiong et al., 2008).

Furthermore, due to the country's importance as a producer and trader of agricultural products, the impact of climate change on China's agriculture sector is expected to have a global reach. Changes in agricultural production in China could

significantly impact global food prices and supplies and the livelihoods of millions of farmers worldwide. As a result, it is critical to investigate the effects of climate change on China's agricultural sector to devise effective mitigation and adaptation strategies. Such strategies include investing in climate-resilient agriculture, promoting sustainable agricultural practices, and developing drought-resistant crop varieties. Failure to address the effects of climate change on agriculture could have disastrous consequences for China and the rest of the world.

Moreover, the agriculture sector's growth will influence the nature of the climatic impact, as its emissions contribute to climate change. Many experts agree that greenhouse gas emissions, such as CO₂, are the primary cause of climate change. Many scientists agree that greenhouse gas emissions, such as carbon dioxide, methane, and nitrous oxide, are the primary cause of climate change (IPCC, 2007). Agriculture is one of the most significant producers of emissions. According to the World Resources Institute's Climate Analysis Indicators Tool (CAIT), greenhouse gas emissions from agricultural sources accounted for 15.4 percent of total emissions in China in 2005, trailing only power and heat and manufacturing and construction. Nitrous oxide emissions from agricultural sources (mostly nitrogen fertilizer application) accounted for 88.6 percent of total nitrous oxide emissions in China. Methane emissions from agricultural operations (mostly from ruminant animals and paddy rice cultivation) accounted for 59.4 percent of total methane emissions. When the repercussions of different emissions are compared, the temperature-increasing potential of nitrous oxide (methane) is 296 times (23 times) that of carbon dioxide (Wang, 2010).

Climate change policy in China dates back to the late 1980s when the Chinese government first recognized the possible effects of climate change on the country. China ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, pledging to reduce greenhouse gas emissions and take action to mitigate the effects of climate change. China launched its first National Climate Change Programme in 2007, outlining its overarching climate change strategy (*Short History of Chinese Climate Policies / Guide to Chinese Climate Policy*, n.d.).

In recent years, the Chinese government has prioritized low-carbon development, focusing on renewable energy and energy efficiency. China said in 2018 that it intends to peak its carbon emissions by 2030 and attain carbon neutrality by 2060. This lofty ambition was strengthened by the 14th Five-Year Plan, unveiled in 2021 (iea.org, 2021). In addition to cutting emissions, China has been aggressively adopting adaptation plans to reduce the country's exposure to the effects of climate change. The Chinese government has recognized the need to adapt to climate change, notably in the agricultural and rural sectors, which comprise most of the country's population.

METHODOLOGY

The study sought to examine the efficacy of adaption measures used by the Chinese government to address the effects of climate change on rural development in China. The study took a qualitative method, relying on secondary data sources such as books, reports, and policy documents. A systematic survey of relevant literature on climate change and rural development in China was used to obtain data. Books, journal articles, government reports, and policy documents were found utilizing academic resources such as JSTOR, ProQuest, and Google Scholar. "Climate change," "rural development," "adaptation measures," "China," and related variations were among the search phrases.

The collected data were thematically analyzed to uncover significant themes and patterns linked to the implementation and efficacy of adaptation measures in rural China. An iterative method was used to identify patterns and articles in the data once rigorously categorized and grouped into categories.

The following research questions led the study: What adaptation strategies has the Chinese government put in place to deal with the effects of climate change on rural development in China? How effective were these adaptation techniques in mitigating the impacts of climate change on China's rural development? What were the main problems and constraints in implementing these adaptation tactics in rural China?

The study provides vital insights into the effectiveness of the Chinese government's adaptation measures for addressing the effects of climate change on rural development in China. It also revealed significant obstacles and constraints, which helped to shape future research and policy.

RESULT AND DISCUSSION

China is an essential player in global efforts to address the challenges posed by climate change. Recognizing its responsibility to contribute to the fight against climate change, China has acknowledged its status as the world's largest emitter of greenhouse gases. As part of this commitment, China has set ambitious goals, such as achieving carbon neutrality by 2060 and peaking carbon emissions by 2030. (Chunping et al., 2022). To meet these targets, China has launched several domestic initiatives. For example, the "Green Great Wall" program aims to restore degraded land while reducing carbon emissions by planting trees and other vegetation. Furthermore, China promotes energy efficiency and conservation and the transition to low-carbon and renewable energy sources such as wind, solar, hydro, and nuclear power. To reduce emissions from the transportation sector, the country is also encouraging the use of electric vehicles.

In addition to these domestic efforts, China is actively involved in international climate change initiatives. China is a signatory to the Paris Agreement and is committed to upholding its end of the bargain. The country is collaborating with other countries to develop and implement strategies for reducing greenhouse gas emissions and mitigating the effects of climate change. Through its participation in international conferences and diplomatic engagements, China is also playing an essential role in advancing international climate negotiations.

While China's efforts to combat climate change are admirable, much more work remains. The magnitude of the challenge necessitates sustained and coordinated efforts on the part of all nations. However, China's leadership in this area is critical, and the success of its initiatives will have far-reaching consequences for global efforts to mitigate the effects of climate change. Climate change affects rural development in China, threatening agriculture, water supplies, and livelihoods. As a consequence, the Chinese government has adopted a variety of adaptation strategies to mitigate these impacts. In this study, we will examine the Chinese government's adaptability strategies for dealing with the effects of climate change on rural development in the country.

According to one of the primary findings in the literature, climate change exacerbates pre-existing vulnerabilities in China's rural areas. According to Wei et al. (2014), extreme weather events such as floods and droughts are becoming more common in rural areas, resulting in significant economic losses and crop failures. Besides that, Ding et al. (2021) discovered that the impact of climate change on rural livelihoods is caused

by changes in temperature and precipitation, which reduce agricultural and livestock productivity. Given these implications, it is critical to recognize the need for policies and programs supporting adaptation and mitigation measures in rural communities. As a result, more research is needed to understand how climate change affects rural communities and how to develop effective policy interventions to address the issues. Various adaptation solutions have been suggested and implemented in rural areas in response to these problems. Promoting drought-resistant crops and irrigation systems is one of the most extensively researched tactics. A study by Raza et.al. (2019), for example, discovered that introducing drought-resistant rice cultivars in rural areas has helped offset the effects of drought on agricultural output. According to another study by Nikolau et al. (2020), the extension of irrigation infrastructure in rural regions has also helped to boost crop output and minimize the risk of drought-related crop failures.

Adaptation strategies have been widely discussed in the literature to address the effects of climate change on rural development. As highlighted in a study by Haibo et al. (2020), one such strategy is the promotion of rural eco-tourism. According to the study, eco-tourism can provide a viable source of income for rural communities while promoting the conservation of natural resources and biodiversity in the face of climate change. The authors do admit, however, that the success of eco-tourism as an adaptation strategy is context-specific and dependent on local conditions. According to the literature, climate change significantly impacts rural development, and various adaptation measures are being developed and implemented to mitigate these effects.

Investing in water conservation and irrigation infrastructure is one of the key initiatives the Chinese government has implemented to counteract the effects of climate change on rural development. This initiative has ensured that water resources remain available for agriculture, hydropower generation, and other water-dependent industries. The Chinese government, for example, has launched the South-to-North Water Transfer Project, which intends to transfer water from the southern areas to the northern and northwestern regions, where water scarcity is more acute (Zhang, 2009).

The South-North Water Transfer Project in China is a large-scale water management and infrastructure project designed to address the country's growing water scarcity crisis. Water will be transferred from the country's wet southern region to the dry northern part via a network of canals and pipelines. The project includes three routes totaling over 1,400 kilometers: eastern, central, and western. The water transfer project's prime motive is the significant water availability disparity between northern and southern China (Freeman, 2023). Water resources are scarce in the north, exacerbated by extensive agriculture and urbanization. On the other hand, the south has abundant water resources but faces water pollution and over-extraction challenges. The project aims to provide water to the northern regions to meet rising demand while relieving pressure on southern water resources.

The South-North Water Transfer Project began in 2002 and has been implemented in stages since then. The project has faced numerous challenges, including technological difficulties, high costs, and public opposition due to community displacement and environmental concerns (Freeman, 2023). The project will also have an economic, social, and ecological impact. On the economic front, the project has generated employment opportunities and aided the growth of rural governments. It has also assisted the development of industry and agriculture in the northern regions by providing a steady water supply. On the social front, the project has resulted in significant displacement of local communities and tensions between various areas and ethnic groups. Concerns have been raised about the project's impact on water quality and ecosystems, as well as the

displacement of wildlife. Despite these obstacles, the project has significantly progressed and provided much-needed water to the northern regions.

The Chinese government has taken various adaptation measures in the agricultural sector to respond to the challenges posed by climate change. One approach that could be taken is to offer assistance to farmers to practice farming methods that are more climate-resilient. The government offers them training, guidance from technical experts, and financial assistance to assist farmers in making the transition toward farming methods that are more sustainable and more resilient to the effects of climate change. The Chinese government has implemented several policies, such as the "One Exemption and Three Subsidies" policy, to ensure the nation's food supply, boost the economy, and make agriculture more resilient to the effects of climate change (Chen & Gong, 2021). Farmers are eligible for various financial benefits due to this policy, including an exemption from certain taxes and subsidies for agricultural machinery, fertilizers, and pesticides. It is anticipated that these initiatives will improve the productivity and resiliency of China's agricultural sector, thereby protecting the livelihoods of rural communities and enhancing the nation's ability to withstand the effects of climate change on its food supply. Aside from these measures, the Chinese government has launched a variety of policies and initiatives to promote rural development and improve rural residents' livelihoods. These policies and programs seek to address the root causes of rural poverty and vulnerability and strengthen rural communities' resilience to the effects of climate change. The Chinese government, for example, has formed a rural revitalization strategy that aims to promote rural development, improve rural livelihoods, and strengthen rural populations' resistance to the effects of climate change (Chen et al., 2021). This strategy comprises several initiatives, such as supporting rural infrastructure, enhancing market access, and encouraging rural entrepreneurship.

Despite the efforts that have been made to implement adaptation strategies in rural areas, it is still unknown how effective these measures will be in mitigating the effects of climate change on rural development in China. Inadequate resources for applying these adaptation strategies present a significant challenge that needs to be addressed to make the most of their potential. The effectiveness of adaptation measures in mitigating the effects of climate change on rural development has been severely hindered due to insufficient funding and inadequate support for the development and implementation of adaptation measures. It will take additional funding and support to practice sustainable adaptation strategies and promote resilience in rural areas, but this is necessary for China to overcome these challenges. In addition, plans ought to be devised and implemented to guarantee that the most efficient adaptation strategies are implemented in China to reduce the adverse effects of climate change on the country's rural development. A further issue is rural communities' limited capacity to adjust to the effects of climate change. This issue includes a shortage of understanding and knowledge about the impacts of climate change and a lack of financial and technical capabilities to enforce adaptive capacity. This problem has limited rural communities' ability to respond effectively to the effects of climate change and the effectiveness of adaptation techniques in mitigating their impacts on rural development.

It is clear that although China has taken significant steps in recent years to address the impact of climate change, the efforts remain insufficient. As the world's largest developing country, China faces significant challenges regarding resources and capacity for rural development. The limited funding for adaptation measures has created a lack of technical assistance and financial resources, leaving many rural communities without the tools to adapt to the changing climate successfully. There is a need for coordinated efforts

by both the government and the private sector to address these challenges and provide support for vulnerable communities.

Furthermore, it is essential to recognize the importance of adaptation techniques for rural development, as rural communities are often the most vulnerable to the effects of climate change. These communities rely heavily on natural resources for their livelihoods, making them particularly susceptible to climate-related hazards such as droughts, floods, and extreme weather events. The successful implementation of adaptation techniques could help to promote rural development, increase food security, and reduce poverty.

To conclude, it is essential to acknowledge the significant challenges that impede the effective mitigation of climate change's impact on rural development in China. However, it is equally important to continue encouraging and implementing adaptive strategies to overcome these challenges. The Chinese government and international organizations have made commendable efforts to promote sustainable development, decrease greenhouse gas emissions, and foster the growth of clean energy alternatives. These efforts must be sustained and amplified to guarantee a more sustainable and promising future for rural communities. It is crucial to recognize that these communities' long-term prosperity and well-being depend on collaborative action and continuous dedication toward mitigating the effects of climate change.

CONCLUSION

China's commitment to reducing its greenhouse gas emissions and combating climate change is commendable. The country has set ambitious goals to achieve carbon neutrality by 2060 and peak carbon emissions by 2030. China has implemented several domestic initiatives to meet these targets, including promoting energy efficiency and conservation, transitioning to low-carbon and renewable energy sources, and encouraging using electric vehicles. China is also involved in international climate change initiatives and is collaborating with other countries to develop and implement strategies for reducing greenhouse gas emissions and mitigating the effects of climate change.

However, climate change significantly impacts rural development in China, and extreme weather events, changes in temperature and precipitation, and water scarcity threaten agriculture, water supplies, and livelihoods in rural areas. The Chinese government has developed various adaptation strategies to mitigate these impacts, such as promoting drought-resistant crops and irrigation systems and investing in water conservation and irrigation infrastructure. One of the significant initiatives implemented by the Chinese government is the South-North Water Transfer Project, which aims to provide water to the northern regions and relieve pressure on southern water resources. This project has faced numerous challenges, including technological difficulties, high costs, and public opposition due to community displacement and environmental concerns. This project's economic, social, and ecological impacts are still uncertain.

Overall, China's efforts to combat climate change are essential, and the success of its initiatives will have far-reaching consequences for global efforts to mitigate the effects of climate change. More research is needed to understand how climate change affects rural communities and how to develop effective policy interventions to address the issues.

CONFLICT OF INTEREST

There is no conflict of interest related to the writing or publication of this article.

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