

Research Article



Addressing the Causes and Effects of Climate Change: Mitigation Strategies and Solutions for a Sustainable Future

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Abstract: This research aims to address the causes and effects of climate change in Afghanistan and develop strategies and solutions for a sustainable future. A qualitative approach was utilized, employing semi-structured interviews with climate change experts selected via snowball sampling. These interviews were audio-recorded, transcribed, coded, and analyzed through thematic analysis. The study identified various causes of climate change in Afghanistan, such as deforestation, fossil fuel combustion, urbanization, ongoing conflicts, industrial activities, inefficient waste management, and poor water management practices. These factors have culminated in escalating droughts, melting glaciers and snow, floods and storms, adverse effects on agriculture and livestock, and increased diseases among humans, animals, and plants. The research underscores the urgent need for mitigation strategies and sustainable solutions for Afghanistan's future. Proposed strategies and solutions include seeking foreign aid, collaborating with national and international organizations, raising public awareness, preventing deforestation and smuggling, implementing water storage measures, learning from other countries' experiences, conducting further assessments and research, expanding greenery, and formulating comprehensive policies and strategic plans for water management. The findings are significant for the Afghan government, national and international organizations engaged in climate change efforts, and policymakers. Given Afghanistan's heightened vulnerability to climate change, it is essential to take proactive measures and prioritize mitigation and adaptation efforts to ensure a sustainable future. Addressing these critical issues will require coordinated action and sustained stakeholder commitment.

Keywords: Dust and Sand Storms; Global Temperatures; Greenhouse; Gas Emissions; Renewable Energy Sources.

1. Introduction

Climate change refers to long-term shifts in weather patterns and global temperatures, primarily driven by human activities, notably fossil fuel burning and releasing greenhouse gases into the atmosphere [1], [2]. This phenomenon has far-reaching implications for our planet and ecosystems. The Earth's climate is undergoing significant changes, including rising temperatures, melting polar ice caps, changing precipitation patterns, and increased frequency of extreme weather events [3], [4]. These changes harm various aspects of life, including natural habitats, agriculture, water resources, and human health. Urgent action is required to mitigate the causes of climate change, reduce greenhouse gas emissions, and adapt to the ongoing impacts. Transitioning to renewable energy sources, improving energy efficiency, promoting

sustainable land and water management practices, and fostering international cooperation are key strategies to address climate change effectively. By taking proactive and collective measures, we can strive for a more sustainable and resilient future for ourselves and future generations.

Climate change is a phenomenon that occurs due to factors such as the dynamic processes of the earth or external factors such as changes in the speed of sunlight and human activities [5]. External factors affecting the climate are called climatic forces. The warming of the earth's climate is currently a big problem, which has had destructive effects on nature, living beings, and every part of life and harms all of them in one way or another [6].

Afghanistan supports eliminating greenhouse gases and reducing the environment's temperature, supporting every measure to improve the environment [7]. The past wars in the country and the use of gunpowder have

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damaged the climate of Afghanistan. Extensive industrial activities at the global level have caused climate change, increasing the earth's temperature. As we know, Afghanistan is the country most affected by climate change, and the level of greenhouse gas emissions is deficient.

Climate change is a global issue transcending national boundaries, requiring collective responsibility and action, particularly from large economic countries that contribute significantly to greenhouse gas emissions [8], [9]. Despite contributing minimally to global emissions, countries like Afghanistan bear disproportionate impacts. Rising temperatures, permanent drought, and frequent floods in Afghanistan have led to decreased agricultural production, increased incidence of diseases in humans, animals, and plants, and exacerbated poverty and internal migration. The destruction of land and forests further compounds these issues, directly affecting the livelihoods and well-being of the Afghan population.

The increase in temperature and changing precipitation patterns in Afghanistan have resulted in severe water scarcity and reduced agricultural yields, threatening food security and economic stability. These environmental stresses contribute to higher rates of diseases as communities struggle with limited resources and deteriorating living conditions. The escalating poverty and internal migration, driven by climate-induced displacement, highlight the urgent need for comprehensive adaptation and mitigation strategies [10]. Protecting Afghanistan's natural resources and enhancing the resilience of its communities are critical steps in addressing the multifaceted impacts of climate change on human life.

Climate changes not only cause changes in the natural environment but also cause unexpected events such as dust and sand storms, floods, and droughts. The shortage of drinking and clean water, the destruction of forests, and the pollution of the residential environment have brought them together. On the other hand, the increase in population has also greatly affected climatic changes and accelerated the pollution process in the residential environment. According to National Environmental Protection Agency reports, Afghanistan's share of greenhouse gas emissions is 0.08 percent [11]. It is negligible, and it can be said that Afghanistan has no role in climate change, but climate change has seriously affected Afghanistan.

This study aims to understand the causes and effects of climate change in Afghanistan, explore mitigation strategies and solutions for a sustainable future, and provide insights to support the development of comprehensive policies and strategies by government, national, and international organizations. Through a

thorough analysis of existing policies, scientific literature, and stakeholder perspectives, the research aims to contribute to the formulation of evidence-based recommendations for policymakers and aid in creating holistic and sustainable climate policies on local, national, and international scales.

2. Literature Review

2.1. Causes of Climate Change

The primary cause of climate change is increased greenhouse gas (GHG) emissions from human activities [12]. Numerous studies have identified the burning of fossil fuels for energy generation, industrial processes, and transportation as the primary contributor to GHG emissions [13], [14]. Deforestation, land-use change, and agricultural practices like livestock farming release GHGs [15], [16].

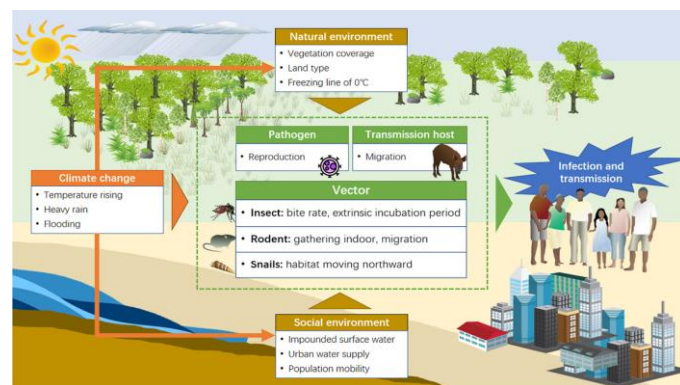


Figure 1. The Main Pathway of Climate Change Impact on The Risk of Vector-Borne Diseases [17].

Positive feedback mechanisms further exacerbate climate change. One prominent example includes the release of methane from permafrost regions, which is triggered by rising temperatures. As permafrost thaws, the organic matter trapped within it decomposes, releasing methane—a greenhouse gas far more effective at trapping heat than carbon dioxide. Similarly, warmer temperatures increase the amount of water vapor in the atmosphere, a potent greenhouse gas, thus creating a feedback loop that accelerates global warming [18].

2.2. Impacts of Climate Change

Climate change has profound and far-reaching consequences for both natural and human systems. Extensive research has shown its adverse effects on ecosystems, leading to shifts in species distribution, altered phenology, and increased extinction risks [19]. These changes threaten biodiversity as species struggle to adapt to rapidly changing environmental conditions.

Additionally, climate change disrupts agricultural productivity through rising temperatures and shifting precipitation patterns, exacerbating water scarcity and food insecurity. The altered climate also increases the prevalence of vector-borne diseases like malaria and dengue fever, posing significant risks to human health [20].

Moreover, climate change is closely linked to the increasing frequency and severity of extreme weather events such as hurricanes, droughts, and heat waves. These events have devastating impacts on communities and economies, causing loss of life, displacement, and significant economic costs. Hurricanes can lead to widespread destruction of infrastructure, while prolonged droughts threaten water supplies and agricultural productivity. Heatwaves pose serious health risks, particularly to vulnerable populations such as older people and those with pre-existing conditions [21]. The pervasive effects of climate change underscore the urgent need for comprehensive mitigation and adaptation strategies to reduce greenhouse gas emissions and enhance resilience to climate impacts.

2.3. Mitigation Strategies

Researchers and policymakers have proposed and evaluated various strategies and solutions to mitigate climate change. Renewable energy sources, such as solar and wind power, have gained prominence as alternatives to fossil fuels, offering the potential to reduce greenhouse gas (GHG) emissions significantly [22]. By transitioning to these clean energy sources, countries can decrease their reliance on carbon-intensive energy production and move towards a more sustainable energy future. Energy efficiency measures, including improved building insulation, advanced heating and cooling systems, and more efficient transportation networks, have shown promise in reducing overall carbon footprints and lowering energy consumption [23], [24].

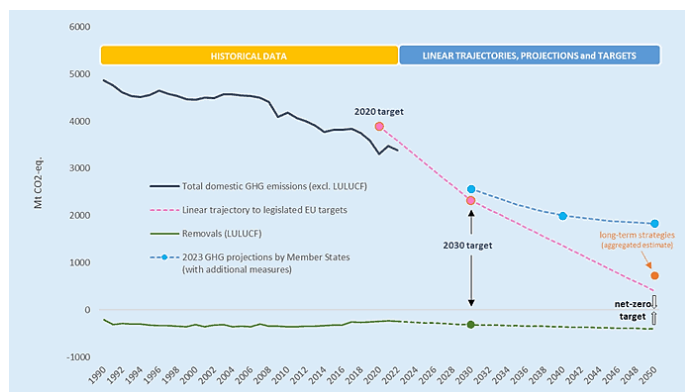


Figure 2. EU Net Greenhouse Gas Emissions, Targets and Required Reductions (MtCO₂-eq) [25].

Efforts to halt deforestation, promote sustainable land management practices, and enhance carbon sequestration through afforestation and reforestation have also been explored as effective mitigation strategies. Preventing deforestation helps maintain existing carbon sinks, while sustainable land management ensures the land is used in ways that do not degrade its ability to sequester carbon. Afforestation and reforestation initiatives aim to increase the number of trees that absorb carbon dioxide from the atmosphere, thus mitigating the effects of climate change. These combined strategies can reduce atmospheric carbon levels and support global efforts to combat climate change [26], [27].

2.4. Adaptation and Mitigation Strategies in Afghanistan

Efforts to adapt to and mitigate climate change in Afghanistan are crucial for building resilience and ensuring sustainable development. Studies highlight the importance of implementing climate-smart agricultural practices, such as improved irrigation systems and drought-resistant crops, to enhance food security in changing climatic conditions [28]. These practices can help stabilize agricultural productivity and support farmers' livelihoods, often the most vulnerable to climate variability. Water management strategies, including rainwater harvesting and efficient irrigation techniques, are essential for addressing water scarcity exacerbated by climate change and increasing demand [29].

Promoting renewable energy sources, such as solar and wind, and improving energy efficiency can significantly reduce greenhouse gas emissions and decrease reliance on fossil fuels. These measures mitigate climate change, enhance energy security, and reduce environmental degradation. By investing in renewable energy infrastructure and encouraging energy-efficient practices, Afghanistan can move towards a more sustainable and resilient energy future [30].

2.5. Causes of Climate Change in Afghanistan

Afghanistan's contribution to global greenhouse gas emissions is relatively low, yet the country remains highly vulnerable to the impacts of climate change [7]. This vulnerability is exacerbated by its reliance on climate-sensitive sectors such as agriculture and water resources, making adaptation strategies essential for its sustainable development. Afghanistan's main drivers of climate change include deforestation, land degradation, unsustainable agricultural practices, and burning fossil fuels. These activities contribute to environmental degradation and increase the country's susceptibility to climate-related stresses [31], [32].

Regional climate variability significantly influences Afghanistan's climate patterns. Factors such as the Indian Ocean Dipole and El Niño-Southern Oscillation play a crucial role in shaping weather patterns, leading to variations in precipitation and temperature that can impact agricultural productivity and water availability [33]–[35]. Understanding these regional influences is vital for developing effective climate adaptation and mitigation strategies tailored to Afghanistan's unique climatic and socio-economic context.

2.6. Impacts of Climate Change in Afghanistan

Climate change has significant implications for Afghanistan's socio-economic development and natural resources. Rising temperatures and changing precipitation patterns lead to increased water scarcity, reduced agricultural productivity, and heightened risks of droughts and floods [36], [37]. These climatic changes undermine food security and economic stability, particularly in rural areas where agriculture is the mainstay of livelihoods. Glacier retreats in the Hindu Kush Himalayas also affect water availability in rivers vital for agriculture and hydroelectric power generation, further exacerbating water resource challenges [38], [39].

Climate change also exacerbates challenges in conflict-affected areas, displacement, and food security. As water and agricultural resources become scarcer, competition over these essential resources can intensify, potentially leading to increased conflict and displacement. Food security is further threatened by reduced crop yields and loss of arable land, making it harder for communities to sustain themselves [40]. These compounded issues highlight the urgent need for integrated climate adaptation and mitigation strategies that address Afghanistan's environmental and socio-economic vulnerabilities.

3. Material and Methods

According to Braun and Clarke [41], this study utilized thematic analysis and semi-structured interviews to investigate the causes and effects of climate change in Afghanistan and potential mitigation strategies and solutions for a sustainable future.

3.1. Research Approach

This rigorous analytical approach facilitated a deeper understanding of Afghanistan's intricate dynamics of climate change. The thematic analysis identified vital patterns and insights within the interview data, providing valuable perspectives on the challenges and potential

solutions related to climate change. The structured methodology ensured that the findings were well-grounded in the data, offering robust support for developing effective and sustainable mitigation strategies tailored to Afghanistan's unique context [41], [42].

3.2. Participants

This research employs the snowball sampling method to determine the sample size. Initially, a small group of professionals is selected based on predefined inclusion criteria. Subsequently, additional participants are recruited through referrals from this initial group, forming a network of 30 participants with relevant expertise. This approach allows for the expansion of sample coverage by leveraging the networks and connections of the initial participants, ensuring a more comprehensive and diverse data set [43]–[45].

3.3. Procedures

3.3.1. Semi-Structured Interview

The researcher develops the semi-structured interview guide to ensure consistency and provide a framework for the interview. However, the semi-structured nature allows for flexibility in exploring additional themes and following up on participants' responses. This approach enables the researcher to gain insight into the participant's perspective, creating a more nuanced understanding of the topic under investigation [46].

3.3.2. Questionnaire Development

The interview guide is developed carefully by referencing relevant literature, identifying key research questions, and considering the study's objectives. Open-ended questions are designed to elicit detailed and insightful responses from participants. This method aims to uncover the central themes in the participants' experiences and perspectives, thereby providing rich qualitative data for analysis [47]–[49].

3.3.3. Pilot Testing

The questionnaire is pilot-tested to ensure clarity, relevance, and effectiveness in gathering the desired information. This step is crucial for refining the questions and improving the interview process. Conducting a pilot study increases the likelihood of success in the primary survey in identifying potential issues and allows for adjustments before the full-scale research begins [50], [51].

3.3.4. Interview Process

During the interview, the researcher actively listens, probes further, and asks follow-up questions to obtain in-depth and comprehensive participant responses. This approach emphasizes obtaining depth and detail in the responses while retaining flexibility in the questioning to adapt to the flow of the conversation and the insights provided by the participant [52]–[54].

3.3.5. Audio Recording

Audio recordings are made during the interviews to ensure accurate transcription and facilitate further analysis. This practice is essential for maintaining the integrity of the data and supporting a thorough analysis. By capturing a verbatim interview record, the researcher ensures that the data collected is comprehensive and reflects the participants' actual words and meanings [54]–[56].

3.4. Data Collection & Analysis

3.4.1. Data Collection and Transcription

The data collection process in this study began with conducting semi-structured interviews, which were recorded in audio format. These recordings were then transcribed verbatim to ensure the accuracy and detail of the conversations. The resulting transcripts allowed researchers to work with rich textual data, a crucial foundation in qualitative analysis. The transcribed data was then systematically coded using the approach outlined by Braun and Clarke [41]. This coding process involved identifying meaningful units within the text and organizing them into relevant categories for the study [57].

3.4.2. Theme Identification

Following the coding process, the next step was identifying themes and sub-themes that emerged from the coded data. These themes and sub-themes were identified through thematic analysis, allowing for a comprehensive exploration of the research topic. Braun and Clarke [41] emphasize the importance of this process in understanding patterns within the data and providing deep insights into the phenomena being studied. In the context of this study, theme identification enabled researchers to organize and interpret the data more effectively, yielding rich and profound findings regarding the causes and effects of climate change in Afghanistan, as well as potential mitigation strategies. Additionally, this approach supports the development of contextual and relevant solutions based on empirical findings [58], [59].

4. Result and Discussion

Thematic analysis of in-depth semi-structured interviews attended by the expert participants generates the following sub-themes related to the two main themes: climate change causes and effects and mitigation strategies and solutions for a sustainable future in Afghanistan. You may find them below:

4.1. Causes and Effects of Climate Change

4.1.1. Deforestation

Deforestation was identified by 87% of participants as a significant contributor to climate change. It exacerbates climate change by reducing carbon sequestration, increasing greenhouse gas emissions, and accelerating soil erosion and desertification. The direct causes of deforestation include prolonged conflict, tree cutting for fuel, illegal logging, and wood extraction for construction and domestic purposes. These findings underscore the critical importance of forest conservation in mitigating climate impacts. Effective strategies must prioritize curbing illegal logging, promoting sustainable land use practices, and supporting reforestation while addressing socio-economic drivers such as poverty and conflict.

The implications of these findings stress the need for a multi-faceted approach to combat deforestation. Strengthening law enforcement, implementing community-based forest management, and offering alternative livelihoods are essential for reducing deforestation pressure. Related research supports these findings, with García et al. [8] linking deforestation to increased greenhouse gas emissions and biodiversity loss, Panagos et al. [60] highlighting its role in soil erosion and land degradation, and Bowen et al. [61] discussing socio-economic drivers and the need for sustainable management practices.

4.1.2. Burning of Fossil Fuels

In a recent survey, 90% of participants reported an increased reliance on fossil fuels during the winter season in Afghanistan. This dependence is mainly due to using traditional energy sources like coal and petroleum for domestic heating, cooking, and electricity generation, stemming from limited access to more modern and clean energy alternatives. This highlights the significant role that traditional energy sources play in daily life, especially within the limited infrastructure and availability of renewable energy technologies.

Moreover, fossil fuel consumption in Afghanistan has broader implications, such as air pollution, respiratory diseases, and environmental degradation. The burning of these fuels also exacerbates climate change through the release of greenhouse gas emissions. The consensus

among survey respondents underscores the critical issues Afghanistan faces regarding energy consumption and its impacts. These findings highlight the urgent need for policy interventions to increase access to clean and sustainable energy alternatives, thereby mitigating the adverse effects on public health and the environment caused by fossil fuel use.

4.1.3. *Changing Agricultural Land to Urban Areas*

According to 78% of participants, agricultural land in Afghanistan is gradually being converted into urban land. This transformation is primarily driven by rapid population growth, urbanization, and an increased demand for infrastructure development, which leads to the loss of fertile land and agricultural productivity. The shift from farming to urban land underscores the pressures of meeting the needs of a growing population and the demands for more urban infrastructure.

Furthermore, converting agricultural land to urban areas has significant environmental consequences. It contributes to deforestation, loss of biodiversity, soil degradation, and a reduced capacity for carbon sequestration, all of which intensify the impacts of climate change in the region. The consensus among respondents highlights the critical environmental and biodiversity issues that arise from this land-use change, stressing the urgent need for sustainable urban planning and policies to mitigate the adverse effects on the environment and climate.

4.1.4. *Decades of Wars Used Explosive Ammunition in The Country*

Ninety percent (90%) of the participants acknowledged that decades of wars in Afghanistan have involved the extensive use of gunpowder and explosive ammunition. This prolonged conflict has led to significant environmental destruction, including deforestation, soil degradation, and the release of various pollutants. These ecological impacts contribute to climate change and exacerbate its effects on the region.

The widespread use of ammunition and gunpowder during the wars has further contributed to environmental degradation, which, in turn, has worsened the impacts of climate change on the population. These effects include increased illnesses and a general negative impact on human life. The consensus among respondents underscores the severe consequences that explosive ammunition and prolonged conflict have had on both the environment and public health in Afghanistan, highlighting the need for comprehensive measures to address these issues.

4.1.5. *Impacts of industrial activities*

Thirty percent (30%) of the participants emphasized how industrial activities in Afghanistan influence climate change. One participant provided insight, stating, "The impacts of industrial activities on climate change in Afghanistan are primarily caused by the emission of greenhouse gases resulting from mud brick furnaces, steel industries, manufacturing, and other related industries, as well as mining processes, exacerbating global warming and environmental degradation." This direct quote from the respondent supports the claim that industrial activities contribute to climate change and environmental degradation in Afghanistan.

4.1.6. *Inefficient Waste Management*

Eighty-one percent (81%) of participants identified waste as a significant factor contributing to climate change. Many emphasized that rapid urbanization in recent years has led to increased waste generation due to population growth and changes in consumption patterns. Insufficient waste management infrastructure, including collection, transportation, and disposal systems, has become a major issue in many areas, where proper waste collection services and disposal facilities are lacking.

Participants noted that improper waste management leads to environmental pollution, affecting soil, water, and air quality. Open dumping and burning of waste release harmful substances into the environment, causing ecological damage and impacting the health of plants, animals, and humans. Additionally, the accumulation of waste in public spaces, such as streets and open areas, detracts from the aesthetics of cities and communities, potentially resulting in social and psychological effects on residents. This unclean and unpleasant living environment contributes to climate change by releasing greenhouse gases, such as methane and carbon dioxide, and exacerbating environmental degradation.

4.1.7. *Inefficient Water Management of Rivers*

Ninety percent of participants highlighted the increased burning of fossil fuels during winter in Afghanistan. The reliance on traditional energy sources, such as coal and petroleum, for domestic heating, cooking, and electricity generation is primarily driven by limited access to modern, cleaner energy alternatives [62]. This widespread use of fossil fuels significantly contributes to air pollution, respiratory illnesses, and environmental degradation.

Moreover, burning fossil fuels exacerbates climate change by releasing greenhouse gas emissions [25]. These findings support the assertion that the burning of fossil fuels in Afghanistan has detrimental effects on both public

health and the environment. Addressing this issue is critical for improving air quality and promoting sustainable energy practices in the region.

4.1.8. *Effects of Climate Change*

Ninety-five percent (95%) of participants noted that the effects of climate change in Afghanistan include increasing droughts, melting of natural glaciers and snow, and a rise in floods and storms. Additionally, they observed adverse impacts on agriculture and livestock, as well as an increase in human, animal, and plant diseases. Participants highlighted that climate change contributes to more frequent and severe droughts, which lead to water scarcity, reduced agricultural productivity, and food insecurity.

Furthermore, they pointed out that rising temperatures are causing glaciers and snow in Afghanistan's mountainous regions to melt, adversely affecting water availability and contributing to river flow variability. A few participants expressed concern that climate change can lead to more intense rainfall events, resulting in increased flooding and storms, which can cause infrastructure damage, community displacement, and loss of life. The impact on food production and livelihoods is particularly critical in rural areas, where agriculture is a primary source of income. This highlights the urgent need for effective adaptation and mitigation strategies to address the region's multifaceted challenges posed by climate change.

4.2. Mitigation Strategies and Solutions for Sustainable Future

4.2.1. *Attracting Foreign Aid for Climate Change*

Eighty-seven percent (87%) of participants indicated that Afghanistan has a minimal contribution to the causes of climate change, with international reports noting that it is responsible for only 0.08 percent of global greenhouse gas emissions. Despite this minor share in contributing to climate change, Afghanistan is one of the countries most severely impacted by its effects, making it highly vulnerable and necessitating urgent aid.

Participants emphasized the importance of developing comprehensive climate action plans for Afghanistan that outline specific mitigation targets and strategies aligned with global goals. They noted that a solid commitment to climate action, fostering partnerships with international organizations, and emphasizing the co-benefits of mitigation efforts—such as improved energy efficiency and reduced emissions—can help attract foreign aid. By leveraging international cooperation and support, Afghanistan has the potential to accelerate the implementation of sustainable and impactful mitigation

solutions, ultimately contributing to global climate goals and enhancing resilience against the impacts of climate change.

4.2.2. *Working To Gather with National and International Organizations*

According to 71% of participants, collaboration with national entities, such as government agencies, research institutions, and the private sector, facilitates the sharing expertise, resources, and best practices necessary for developing effective mitigation plans. This cooperative approach is essential for fostering comprehensive and impactful responses to the climate crisis in Afghanistan.

Many participants emphasized that working alongside national and international organizations is vital for implementing effective mitigation strategies and solutions to address climate change in the country. By leveraging the strengths and capabilities of various stakeholders, Afghanistan can enhance its efforts to combat climate change and build resilience against its adverse effects. This multi-faceted collaboration is crucial for creating sustainable, long-term solutions to environmental challenges.

4.2.3. *Creating Public Awareness About Climate Change*

According to 67% of participants, public outreach campaigns, education programs, and community engagement initiatives can help raise awareness about the causes and impacts of climate change and the importance of acting. Moreover, building an understanding to support climate-friendly policies and initiatives will encourage individuals, communities, and businesses to embrace low-carbon practices, reduce emissions, and adopt resilient approaches. The 67% of participants highlighted that creating public awareness about climate change in Afghanistan is crucial for promoting mitigation strategies and solutions.

4.2.4. *Preventing Deforestation and Smuggling*

Ninety-six percent (96%) of participants reported that deforestation significantly contributes to carbon emissions and the loss of vital ecosystems. One participant suggested that Afghanistan could combat this issue by enforcing stricter regulations and penalties against illegal logging and wood smuggling. Strengthening forest management practices, public awareness campaigns, and community engagement programs can educate local populations about the importance of forests for climate regulation and biodiversity conservation.

The majority emphasized that deforestation and smuggling can be prevented through robust forest

management and enforcing regulations and penalties. This consensus highlights the necessity for comprehensive strategies that combine legal, educational, and community-based approaches to address and mitigate the adverse effects of deforestation in Afghanistan.

4.2.5. *Making a National Campaign for Greenery*

According to 71% of participants, the national campaign for greenery is expected to bring positive changes to communities. The remaining participants further supported this sentiment and highlighted that the campaign could incorporate various strategies, such as increasing public awareness through educational programs, incentivizing tree planting, promoting urban greening initiatives, and encouraging sustainable practices in urban and rural areas.

Most respondents emphasized the myriad benefits of green spaces, including improved air quality, enhanced biodiversity, and overall well-being. This campaign has the potential to inspire individuals, communities, and businesses to actively engage in efforts to create a greener and more sustainable future for all. The campaign aims to foster a collective movement towards environmental stewardship and resilience by integrating education, incentives, and sustainable practices.

4.2.6. *Store The Rain and Flood Water to Increase the Volume of Water Storage*

According to 93% of participants, there has been a noticeable decrease in freshwater resources across various provinces of Afghanistan. Many emphasized the importance of capturing and storing rainwater and floodwater as a strategy to secure additional water resources. This approach not only reduces reliance on existing freshwater sources but also enhances water availability for various purposes.

The majority of participants highlighted the need to establish a proper mechanism in collaboration with national and international governments to support communities in implementing rainwater and floodwater storage initiatives. Such efforts are viewed as essential for ensuring a sustainable future and effectively managing water resources in the face of ongoing challenges related to water scarcity.

4.2.7. *Learn From the Experiences of Other Countries on Climate Change*

According to 76% of participants, the government and related organizations should formulate a comprehensive policy on climate change while learning from the experiences of other countries. Many emphasized that

successful approaches from nations that have effectively reduced greenhouse gas emissions while achieving economic growth could serve as valuable examples for Afghanistan.

The majority of participants stressed the critical importance of developing a comprehensive policy on climate change to ensure a sustainable future. They believe that by adopting well-informed strategies and drawing lessons from international best practices, Afghanistan can effectively address its climate challenges while promoting social and economic well-being for its citizens.

4.2.8. *Implement Projects in Different Areas of Environmental Protection in Afghanistan*

Ninety-six percent (96%) of participants indicated that Afghanistan is a diverse country with various regions that could greatly benefit from environmental protection projects. Some participants noted that implementing initiatives to protect and restore forests, mainly through reforestation efforts in provinces like Paktia and Nangarhar, can help combat deforestation, prevent soil erosion, and preserve biodiversity. Others emphasized the importance of developing sustainable water management systems, especially in regions like Kandahar and Herat. These can enhance irrigation techniques, promote efficient water use, and address water scarcity issues.

Participants advocated for expanding renewable energy infrastructure, such as solar and wind power installations in Kabul and Balkh, to reduce reliance on fossil fuels, decrease greenhouse gas emissions, and ensure sustainable energy access. They also emphasized the importance of implementing waste management projects in urban centers like Kabul, Herat, and Mazar-e-Sharif to improve disposal practices, promote recycling, and reduce pollution. Additionally, promoting sustainable farming practices, such as organic farming and agroforestry in regions like Kunduz and Helmand, can enhance soil fertility, conserve water, and minimize chemical inputs. Furthermore, developing climate change adaptation strategies in vulnerable areas like Badakhshan and Nimruz is crucial, with initiatives such as building resilient infrastructure, promoting drought-resistant crops, and implementing early warning systems for natural disasters.

4.2.9. *More Assessments and Research Should Be Done on Climate Change in Afghanistan.*

Seventy-five percent (75%) of participants expressed that additional assessments and research on climate change in Afghanistan are necessary. They underscored the importance of implementing robust mitigation strategies and solutions to ensure a sustainable future. One participant emphasized the need for extensive

assessments and research alongside adopting strategies such as transitioning to renewable energy, implementing sustainable agricultural practices, managing water resources effectively, and promoting climate-resilient infrastructure.

Participants highlighted that by combining increased assessments and targeted research on climate change with these mitigation strategies and solutions, Afghanistan can pave the way for a sustainable future. This approach will not only enhance the understanding of the unique challenges posed by climate change in the country but also facilitate the development of effective interventions that promote environmental sustainability and resilience in the face of ongoing climate-related threats.

4.2.10. *Expansion and Proper Keeping of Green Plants and Forests*

According to 70% of survey participants, the development and practical preservation of green plants and forests are essential for combating climate change and ensuring a sustainable future. The sustainability of forests and the expansion of green vegetation play a critical role in addressing climate change challenges while maintaining the balance of global ecosystems. Effective forest management is vital for reducing greenhouse gas concentrations in the atmosphere, thus mitigating the adverse effects of climate change [63]–[65].

Additionally, forests provide habitat for over 80% of terrestrial species, including animals, plants, and fungi, which are crucial for preserving the biodiversity necessary for ecosystem stability and resilience [66], [67]. By implementing sound management practices and fostering active community participation, the benefits of forests can be maximized for both the environment and humanity. This approach not only aids in climate change mitigation but also promotes comprehensive sustainability for future generations.

4.2.11. *Make a Comprehensive Policy and Strategic Plan for Water Management*

Ninety-five percent (95%) of participants emphasized that water is crucial for a sustainable future. They called for the government to develop a comprehensive policy and strategic plan for water management. Such a policy should guide the government, relevant organizations, and communities in strategically constructing small and large dams and irrigation systems throughout the country.

Participants highlighted that by implementing a comprehensive policy and strategic plan for water management in Afghanistan, the nation can mitigate the impacts of climate change, ensure equitable access to water, promote sustainable development, and secure a

sustainable future for its people and ecosystems. With adequate water management practices, Afghanistan can address current water scarcity challenges and enhance resilience against future environmental stresses, ultimately contributing to the overall well-being of communities and the preservation of natural resources.

5. Conclusion

The research on addressing the causes and effects of climate change in Afghanistan has shed light on the urgent need for mitigation strategies and solutions to ensure a sustainable future for the country. The identified causes, including deforestation, fossil fuel consumption, land conversion, and inefficient waste and water management, have contributed to adverse effects such as drought, glacier and snow melt, floods, storms, and increased disease prevalence.

To address these challenges, the study emphasizes the importance of collaborative efforts involving the government, national and international organizations, and the public. Mitigation strategies such as attracting foreign aid, forming partnerships, raising awareness, preventing deforestation and smuggling, implementing water storage initiatives, learning from other countries' experiences, and expanding green areas and forests are crucial steps towards sustainable development.

The findings of this research have significant implications for policymakers and climate change organizations in Afghanistan. Given the country's vulnerability to climate change, it is imperative to prioritize developing and implementing comprehensive policies and strategic plans. By incorporating the identified mitigation strategies and solutions, Afghanistan can work towards a sustainable future, mitigating the impacts of climate change and fostering resilience in the face of environmental challenges.

6. Direction for Future Studies

Conducting longitudinal studies in Afghanistan would provide a comprehensive understanding of long-term climate change trends and impacts, offering valuable insights into the effectiveness of implemented mitigation strategies over time. The research would capture diverse perspectives and enrich the development of inclusive, context-specific mitigation strategies by involving a broader range of stakeholders, such as local communities, indigenous groups, and non-governmental organizations. This collaborative approach ensures that the voices of those directly affected by climate change are heard, leading to more sustainable and relevant solutions.

Additionally, conducting economic assessments of the costs and benefits of various mitigation strategies would equip policymakers with crucial information about the feasibility and trade-offs of different approaches. Integrating climate modeling techniques can further enhance the understanding of future climate scenarios and their specific impacts on Afghanistan, helping prioritize and effectively tailor mitigation strategies. Evaluating the effectiveness of existing policies and strategic plans related to climate change and identifying improvement areas would support evidence-based policy-making and enhance the country's adaptive capacity. Facilitating knowledge exchange and collaboration with other countries facing similar climate challenges would allow Afghanistan to learn from their experiences and best practices, informing the development of more effective and context-specific mitigation strategies.

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