Impacts of Climate Change in Afghanistan and an Overview of Sustainable Development Efforts

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Abstract:
Afghanistan is ranked fourth of the most vulnerable countries to climate change. Climate change impacts livelihoods, food insecurity, and displacement caused by human induce-activities like deforestation and land pasture degradation. Drought is the major shock affecting 64% of household in 2024. The study provides a comprehensive analysis of the impacts of climate change in Afghanistan and the country’s sustainable development efforts. This was done through an integrative literature review using database like Google Scholar, PubMed, Scopus and Web of Science with a total of 80 articles spanning from 2015 to 2024. The study indicated that sustainable development efforts is impacted by climate change with agricultural sector projected to decline in wheat, rice, and barley (28%, 4.92%, 387kg respectively) by 2050. This not only impacts the country economy but also had an impact of SDG (Goal 1, 2, 3, 6, and 8). The temperature is expected to reach 1.5°C and 3°C by 2050 and rainfall by 25%. Precipitation will decline by 12-25m by 2050. Even though sustainable development efforts have been implement in area of health and agriculture with focus on reducing temperature that affect grain crops, 59.5% of people still experience food insecurity. Reforestation, conservation, and community awareness through community base programs has been enhanced. However, these initiatives are hampered by lack of regulations, government instability, and limited finance. To counter the impacts of climate change in Afghanistan, the study proposed recommendations such as international cooperation, funding for sustainable infrastructure in health, agriculture, and water resource management.
Keywords: Climate Change, Impacts, Sustainable Development Goal (SDGs), Non-Government Organizations, Adaptation, Afghanistan.

Introduction

Afghanistan is one of the most vulnerable countries to climate change and environment-induced fragility (Eckstein, Künzel, & Schäfer, 2021), ranking fourth on the European Commission’s INFORM Risk Index 2024 (Ikram, Jamalzi, Hamidi, Ullah, & Shahab, 2024) (Figure 1). Environmental degradation continues apace and climate-induced shocks have only expanded. In recent years, water shortages and irregular snow and rainfall patterns have had a major impact on livelihoods as over 60% of the population relies on rain-fed agriculture. Drought remains the most widely experienced shock across the country (Soberg, 2024), with 64% of households reporting that they have been affected by it, a 25-percentage-point increase from 2021. Deforestation, land and pasture degradation, and floods continue to have severe impacts on livelihoods, food security, and displacement, increasing the risk of local conflict (de Clerck et al., 2023).

Afghanistan, a landlocked highland nation spanning 652,000 square kilometers, lies at the nexus of Central and South Asia, situated between 29°35’ to 38°40’ latitude and 60°31’ to 74°55’ longitude. Bordered by Uzbekistan, Tajikistan, and Turkmenistan to the north, China to the northeast, Pakistan to the south and east, and Iran to the west, the country is predominantly characterized by mountains and plateaus, covering 82% of its terrain, while rocky deserts and dry steppes prevail as the dominant ecosystems (Mehrad, 2020) (Figure 2).

Around 1.8% of Afghanistan’s landmass is forested, with approximately 12% being arable land (FAO, 2016). Presently, the nation is grappling with severe droughts predominantly afflicting the southern, eastern, and central regions due to low precipitation, while seasonal floods pose risks to the northern and northwestern provinces. The climate is characterized by a continental arid and semi-arid climate, featuring cold winters and hot summers, with temperatures ranging from as high as 50°C in summer to as low as -20°C in winter. Maximum precipitation typically occurs during winter and spring, except for the southeastern parts of the country (Hassanyar, Hassani, & Dozier, 2017).

Since 1960, Afghanistan, like many arid and semi-arid regions, has experienced significant impacts from climate change, including the expansion of dry lands, heightened droughts, and increased agricultural vulnerability (Ababaei & Ramezani Etedali, 2019; Huang et al., 2016). Over this period, the mean annual temperature has risen by 1.8°C, with the most substantial increases observed in the Southern Plateau, Northern region, Central Highlands, and Hindu Kush Mountains (Mehrad, 2020).

![Figure 1. Most At-Risk Countries in 2024 (Inform Risk Index data)](Source: European Commission Disaster Risk Management Knowledge Centre (2024)
Climate change poses significant challenges to sustainable development efforts in Afghanistan across various sectors. The country's agricultural sector, crucial for its economy and employment, faces declining cereal yields due to rising temperatures, with a projected decrease in wheat, rice, and barley yields by 21-28%, 4.92-6.10%, and 387-535 kg/ha, respectively, by 2050 (Sarwary, Samiappan, Khan, & Moahid, 2023). Additionally, climate change impacts health, increasing susceptibility to infectious diseases and respiratory issues among the population (Masood et al., 2022). Water resources, heavily reliant on glacier melt, are at risk due to glacier shrinkage, potentially leading to a decline in water supply (J. Shokory, Horton, Schaefli, & Lane, 2023; J. A. Shokory, Schaefli, & Lane, 2023). Afghanistan's vulnerability to climate change underscores the urgent need for targeted actions to mitigate its adverse effects on agriculture, health, and water resources, aligning with sustainable development goals such as Zero Hunger and Climate Action (Mehrad, 2020). Despite these constraints, there are notable efforts and initiatives aimed at fostering sustainable development in Afghanistan. Projects focusing on renewable energy, sustainable agriculture, and water management are gaining traction, supported by both national and international organizations. For example, the promotion of solar energy and micro-hydropower projects seeks to provide reliable and sustainable energy sources, especially in remote areas.

Sustainable agricultural practices, such as drought-resistant crops and improved irrigation techniques, are being introduced to mitigate the impact of climate variability on food production. Community-based approaches to natural resource management are also being implemented to enhance local resilience to environmental changes.

However, these efforts face significant challenges. The lack of infrastructure, limited access to technology, and insufficient financial resources hinder the scalability and sustainability of development projects. Additionally, the ongoing conflict and political instability pose serious risks to the continuity and success of these initiatives. This review aims to provide a comprehensive analysis of the effects of climate change on Afghanistan and measure the efficiency of the country's sustainable development effort. Thus, this study will contribute to Sustainable Development Goal 1 (No Poverty); 2 (Zero Hunger); 3 (Good health and well-being); 6 (Clean Water and Sanitation); and 8 (Decent work and Economic Growth).

Review of Relevant Literature

Climate Change Context in Afghanistan

Afghanistan is a part of both the Central Asian and South Asian regions, which are suffering from severe climatic crises like increasing heat waves, droughts, and floods (Safi, Mujeeb,
According to experts, there is a connection between heat waves, droughts, and climate change. Heat stress brought on by the climate will worsen water shortage for irrigation and aggravate drought (Mbah, Shingruf, & Molthan-Hill, 2022). The country is among the nation's most susceptible to the effects of climate change globally (Jawid & Khadjavi, 2019). Afghanistan is sixth in the world in terms of how much the effects of climate change are affecting it (Sabbaghi, Nazari, Araghinejad, & Soufizadeh, 2020), placing 176th in the 2019 ND among 181 nations-GAIN Index (Eckstein et al., 2021). Afghanistan is the sixth-most affected country by extreme weather occurrences, according to a recent UN assessment. It is already a hotspot for violence and migration spurred on by conflict and the effects of climate change. This is expected to rank among the nations with the highest rates of migration and displacement brought on by climate change. By 2050, five million people in Afghanistan will have to leave their homes owing to climate-related calamities, even if global warming is kept to 1.5 °C (Sawas & Bose, 2021). Climate change has increased both the severity and frequency of extreme events, such as droughts and flooding, in the country in recent years, and it is predictable to do so in the coming years, and it is predictable to do so in the coming (Safi et al., 2024). Afghanistan's natural environments, which have already suffered from over-exploitation, inappropriate management, from the many years of conflict in the nation. For example, it is estimated that soil erosion affects more than 80% of Afghanistan's land (Najmuddin, Li, Khan, & Zhuang, 2022). The many natural disasters that frequently occur, such as avalanches, floods, droughts, and landslides, as well as long-term erosion, are associated with climate change (Birkmann et al., 2022).

Afghanistan is separated into five distinct climate zones (Hindu Kush Region, Northern Plains, Central Highlands, Eastern Slopes, Southern Plateau, and the Third Central Highlands) (Aich et al., 2017). It is often listed as one of the nation’s most susceptible to climate change (Aich et al., 2017; Kreft, Eckstein, Dorsch, & Fischer, 2015). Due to a shortage of money and housing, many of families in Kabul were living in open spaces (Safi et al., 2024). As a result of both a high degree of exposure to climatic variations and a low capacity for adaptation. Afghanistan is mostly helpless to climate change due to the four decades of armed war that have wrecked the nation's infrastructure, crippled its institutions, and resulted in widespread poverty and underdevelopment (UNEP, 2003). The degradation of natural resources, underdevelopment, a weak economy, a lack of ability to adapt, and increased exposure to climate change are all examples of these circumstances (Aich et al., 2017), have rendered Afghanistan among the states with the highest climate change vulnerability (Kreft et al., 2015).

Since 1960, severe climate change effects have been seen by semi-arid and arid countries like Afghanistan, leading to an extensive spread of dry lands, droughts, and increased agricultural susceptibility (Ababaei & Ramezani Etedali, 2019; Huang et al., 2016). The initial thorough and methodical examination of Afghanistan's climate data was carried out by (Aich et al., 2017), shown that, between 1951 and 2010, Afghanistan experienced a warming of 1.8 °C this increase in temperature is greater than the global average. These adjustments had a negative impact on several important industries, such as agriculture, energy, and water resources. They also brought about flash floods, droughts, soil erosion, and environmental damage. (Dewi, 2010; Ghulami, 2017). The impact of climate change is contingent upon the escalation of greenhouse gas and aerosol emissions, as well as the susceptibility of the climate system to such emissions (Douglas et al., 2017). The average yearly temperature in Afghanistan has increased by 1.8°C since 1950. The Southern Plateau has experienced the largest temperature increase, at 2.4°C, followed by the Northern region at 1.7°C, the Central Highlands and the Hindu Kush Mountains at 1.6°C, and the Eastern region at 0.7°C. However, Afghanistan does not significantly increase greenhouse gas emissions and less than 0.5 percent of the world's emissions come from it. According to data from the World Bank, the usual Afghan emits 0.2
metric tons of carbon dioxide annually (Stromquist, 2019).

Based on several scenarios, climate models predict that nationwide temperatures would rise by 1.7–2.3 °C from 2006 to 2050 and then by 2.7–6.4 °C until 2099. Regarding future precipitation in Afghanistan, there is a great deal of uncertainty and on several scenarios, the precipitation across the entire country will fall by 1.6 to –3.8 and then by 2.7–13.1 to –18 percent until 2050 and 2099, respectively (Aich et al., 2017). Afghanistan’s normal hotness has increased by 1.8 °C since 1950, which is significantly higher than the 1.1–1.2 °C global average. Over the previous 30 years, the frequency of dense rain proceedings has improved by up to 25% (Safi et al., 2024). To analyze the effects of climate change, preliminary regional and local climate change scenarios are required (Mehrad, 2020).

**Temperature**

According to current trends, Afghanistan’s mean temperatures would climb between 1.5°C and 3°C till the 2050s and between 2.2°C and 6.3°C by the 2100s under RCP 8.5 (High Emission Scenario). RCP 2.6 (Low Emission) is an optimistic scenario that predicts an increase of 1.5°C until the 2050s and 2.5°C by the 2100s. Global emission scenarios determine how both scenarios actualize or fluctuate (Mehrad, 2020). Both scenarios predict significant warming across the nation, with the northern plains, the Hindu Kush, and the Central Highlands experiencing the worst temperature increases (Fig. 3).

**Precipitation**

The assessment of climate change trends is subject to varying degrees of uncertainty since it can be challenging to project relevant climatic components like precipitation (Maljean-Dubois & Wemaere, 2017). It is anticipated that Afghanistan’s yearly precipitation will vary greatly throughout the nation, declining by about 12 to 25 mm by the 2050s and 15 to 50 mm by 2100. Rainfall reductions had a major impact on the forests in the east, west, and north, particularly on the forest species in the provinces of Badghis, Balkh, and Samangan. Soil erosion intensified and exacerbated the pasture’s fertility as a result of fluctuating precipitation and intense downpours. The conversion of wetlands to agricultural land and an increase in overgrazing have resulted in significant degradation and decreased production of the land. Because of the heat and humidity, certain forest trees have not been able to grow properly longitudinally or volumetrically. One of the significant consequences of climate change in
Afghanistan's woods is the introduction of pests and illnesses. Heavy precipitation generally falls in the spring and winter, according to an analysis of precipitation trends in Afghanistan from 1950 to 2019. There is most rainfall in January, February, and March, and least in September and July. Simultaneously, there has been a notable 32% decrease in precipitation in the spring, but it stayed constant in the winter. Rainfall in Afghanistan has significantly decreased since 1950, and this trend is probably going to continue (Mehrad, 2020). With a few exceptions in the northeast and north, springtime precipitation is expected to decline. Because of excessive evaporation, the winters have gotten drier over the past 50 years, and this tendency is predicted to continue. The Pamir and Wakhan glaciers, the source of the rivers in northern Afghanistan, shrunk as much as 18% by 2019 and are predicted to shrink by roughly 15.9% in 2050 and 27.3% in 2100, respectively. The southern and northeastern (Hindu Kush) regions will see a rise in precipitation of roughly 30 to 40 mm under the current optimistic scenario (Mehrad, 2020).

Due to a scarcity of water, large tracts of potentially productive land are currently uncultivated because of the effects of climate change, Afghanistan's mean annual precipitation has decreased by 2% every decade since 1950, mostly in the early spring and summer (Jacobs, Schloeder, & Tanimoto, 2015; Savage, Dougherty, Hamza, Butterfield, & Bharwani, 2009). The production of cattle and agriculture was little affected by the drought; it is estimated that over 60% of the animals in Afghanistan perished (Hossain et al., 2020). Due to its effects on farmlands, the drought has severely hampered agricultural output, notably wheat (Safi et al., 2024).

Water Resources
The resources of water have been vulnerable to various changes in weather patterns. The effects of climate change are mostly linked to variations in the quantity and quality of water resources in Afghanistan. Five river basins, wells, and traditional reservoirs carry the water needed for drinking, irrigation, and the upkeep of wetland ecosystems in Afghanistan. The primary sources of water for these basins are rainfall and the yearly melting of snow in the Baba, Hindu Kush, and Pamir mountains (Mehrad, 2020).

The sustainable water supply of Afghan communities was threatened by the drop in...
water levels and the severe droughts that hit level basins, reservoirs, and groundwater systems. This resulted in a number of catastrophes, including as disease outbreaks, violence, and population relocation. Rapid melting of snow and glaciers has also increased the frequency of floods, which has killed many people and worsened environmental conditions (Mehrad, 2020). Farming is the sector greatest sensitive to the effects of climate change, after water resources. Reduced river flow, increased soil evaporation, and decreased rainfall throughout the cultivation seasons are some of the variables that have had a significant impact on Afghanistan's agricultural production and food availability. Increased poverty and population displacement have resulted from declining crop yields and vegetation, particularly in the country's west and southwest, as a result of rising temperatures and altered rainfall patterns (Karki, Bhatta, Devkota, Acharya, & Kunwar, 2021).

Afghanistan has warmed twice as much as the world as a whole in some areas. More evaporation would result from the rising temperatures, endangering supplies of water necessary for life (Aich et al., 2017; Eckstein et al., 2021). The International Center for Integrated Mountain Development projects that by 2100, the volume of glaciers in the Hindu Kush Himalaya region could drop by as much as 90% (Jones, 2020). And reduced precipitation and rising temperatures are the two most obvious indicators of Afghanistan’s climate change effects.

Figure 5. Melting Glaciers in Afghanistan: Shows the Visual Impact of Climate Change on Afghanistan's Water Resources
Source: Nikzad (2021)

Figure 6. Hindu Kush Mountains, Afghanistan: The Source of Much of Afghanistan's Water Through Snowpack Melt
Agriculture

Almost all economic activity and population growth are reliant on agriculture, especially subsistence farming (Aich et al., 2017). The most important sector of Afghanistan's economy is agriculture. Because nearly half of Afghanistan's GDP comes from agriculture and around 80% of the country's population depends on it for a living (Ahmad & Wasiq, 2004; Khaliq & Boz, 2018). Due to the pervasive poverty in Afghanistan, especially among farmers (Haque, Sahibzada, Shome, Haven, & Lee, 2018).

Globally, agricultural productivity will decline due to climate change by 16%, with underdeveloped nations like Afghanistan experiencing a reduction of 21.3% (Kassaye, Shao, Wang, Shifaw, & Wu, 2021). Approximately 26% of Afghanistan's GDP is derived from agricultural products (Muradi & Boz, 2018). Afghanistan has historically been an agricultural nation. Despite accounting for only about 22% of the country's GDP, agriculture is nevertheless a significant industry that provides a living for the impoverished rural populace (Haque et al., 2018). A government data states that the yield of the wheat harvest decreased by around two million tons in 2021. In addition, a shortage of water and feed has put almost three million creatures in risk of going extinct (Safi et al., 2024).

In the coming decades, climate change will pose a significant threat, particularly to Afghanistan. Because its' economy mostly driven by agriculture, which also increases internal manufacture and ensures food safety (Safi, 2023). It will have a major impact on food security and agriculture. A one-degree rise in temperature has been proposed to cause a ten percent shift in the ecosystem and a twenty to thirty-five million ton loss in cereal production (Tamaki, Nozawa, & Managi, 2017). Thus, it is essential to improve farmers' ability to adapt to the impacts of climate change and risky weather events through agricultural adaptation. Research indicates that smallholder farmers have been adapting their farming methods to the effects of climate change in many least developed as well as developing countries (Khanal, Wilson, Hoang, & Lee, 2018; Uttam Khanal, Wilson, Lee, & Viet Ngu Hoang, 2018).

Figure 7. The Chart Indicates that More than 60% of the Population in Afghanistan are Suffering from Severe Drought.
Source: Collins (2021)
The agriculture sector will be considerably more vulnerable to climate change due to rising temperatures and altered precipitation patterns (Omerkhil, Chand, Valente, Alatalo, & Pandey, 2020). Afghanistan's base of fertile agricultural resources is approximately 8 million hectares, or 12% of the country's total geographical area (Bakhtani, 2002). The nation's socioeconomic structure, food security, and way of life were all directly impacted by these shifts (Dewi, 2010; Parto, 2014). In Afghanistan, the damage caused by wind and water to topsoil is extremely severe. It's possible that soil erosion will affect more than 80% of the area. Roughly 5 percent of the entire land area, or 3 million hectares, are thought to be under irrigation (Savage et al., 2009). In Afghanistan, irrigation is used to grow about 85% of the total crops that are planted. In its irrigated land necessary for food security, and increased average rainfall is beneficial for agriculture (Bakhtani, 2002).

Forest and Grass Lands

Since woods and grasslands are essential to maintaining a sustained life cycle, their environmental worth outweighs their economic value. About 1.1 million hectares, or 1.6% of Afghanistan's total land area, are covered by forests (Muradi & Boz, 2018). Decades of conflict, deforestation, and forest fires have caused almost 68% of the nation's forests to vanish. There are currently 31 million hectares of grasslands in the nation, or 49% of the total land area (Mehrad, 2020). Precipitation patterns, rivers, birds, groundwater, land temperature, and soil humidity were all impacted by climate change. The phenomenon of climate change and worldwide heating has worsened food uncertainty and escalated deforestation and soil erosion rates in Afghanistan. The occurred in the forested Nuristan area of Afghanistan, which is mountainous and has been heavily burned by forest fires. In 2022, the fire in Afghanistan consumes 185 acres of forest (Safi et al., 2024).

Biodiversity

Afghanistan's environmental sustainability is mostly determined by the variety of living things. For the maintaining environmental stability, biodiversity offers significant economic advantages. More than 700 different species of birds, animals, amphibians, reptiles, butterflies, fish, and 3,500–4,000 native vascular plant species may be found in Afghanistan (Baizayee,
Doosti, & Sedigi, 2014). Climate change has been a major factor in the decline of biodiversity during the past 50 years, posing several dangers to it. A wide range of animal and plant species can be found in Afghanistan's five permanent and seasonal river basins. However, in the last 30 years, they have lost around 24% of their biodiversity (Mehrad, 2020). According to some estimates, a 1-degree rise in temperature might outcome in a 10% alteration of the ecology and a 20 - 35 million tons decrease in cereal production (Tamaki et al., 2017). Raising temperatures and decreasing rainfall in most of Afghanistan's northern, northeastern, and central regions have resulted in a severe water scarcity for the majority of the country's mammal and bird species, forcing them to migrate to protected areas like China's Wakhan National Park and Tajikistan's Wakhan National Park. More than 413 species perished and bird populations migrated as a result of the ecology being damaged by the absence of water resources in Hamoun, Sindan, Puzak, and Saberi (Mehrad, 2020). Future temperature trends indicate that animal species particularly deer and snow leopards will be highly vulnerable to extinction as a result of climate change.

![Image showing impact of wildfire on livestock and biodiversity](source: Euromoney (2021))

**Natural Resources**

Afghanistan has suffered greatly as a result of climate change, which has an impact on the nation's natural resources and agriculture (Safi et al., 2024). Food production and the availability of natural resources are delicate and vulnerable in such a broad range of climates and geographical areas (Hu & Han, 2022). Over 80% of the nation's population depends on this natural resource, but serious environmental issues like pollution, aquifer depletion, deforestation, desertification, biodiversity loss, and climate change all have a detrimental effect on the resilience of rural livelihoods in the nation (Přívara & Přívarová, 2019). Climate change has profound effects on a range of economic sectors, natural resources, human communities, and biodiversity, all of which have a negative impact on food security and environmental sustainability (Sabbaghi et al., 2020). Afghanistan is currently facing several ecological problems, including diminishing food yields, water scarcity, population growth, and land degradation. Afghanistan's natural resource base has been severely degraded as a result of conflict and the effects of climate change, and many of the country's ecosystems are expected to go through an ecological transition (Bank, 2018; Přívara & Přívarová, 2019). According to research, 80.7% of Afghanistan's landmass is at risk of becoming desert. Earths and enough water are taken for approved for fruitful agriculture and food security in the nation's agriculturalists with degraded land deal with food insecurity and revenue victims. Climate change is predicted to have a negative impact on crop output by raising
crop water stress and decreasing yields in rain-fed agriculture (Gohar & Cashman, 2016).

**Food Security**

The four pillars of food security availability, access, use, and stability may be impacted by climate change. Consequently, there has been attention paid over the past few years to the possible impacts of weather change on food security (Gohar & Cashman, 2016). Almost half of Afghanistan's population goes hungry as a result of severe drought and flooding brought on by climate change (Kurnia & Febriana, 2022). Afghanistan is seeing a growing amount of land degradation. Since 1978, the area of arable land has dropped by around 60% (Safi et al., 2024). Food insecurity is made worse by the loss of arable land resources brought about by urbanization, soil erosion, desertification, salinization, and inefficient farming methods. Since 1978, there has been an average yearly decrease in agricultural production of 3.5 percent, which translates to a damage of 30 percent of pastures and cultivated land due to poverty or desertion (Savage et al., 2009).

There is a noticeable decline in the productivity of rain fed, irrigated land during dry spells, which results in a shortage of food on the market and higher prices. Climate change is connected to Afghanistan's protracted, severe drought. Due to rising food prices and employment losses brought about by the drought, half of the population now lives in poverty. Reduced crop output results from decreased water availability, which lowers overall productivity (Gohar & Cashman, 2016). Afghanistan's climate is predicted to see temperature rises, droughts, heat waves, changes in precipitation (including a reduction in mean yearly precipitation and a rise in precipitation amount), snow and icy lake melt, and a higher risk of fresh food contamination.

Afghanistan is regarded as one of the nations with the greatest food insecurity, with a high population. Afghanistan was placed 109th out of 121 nations in 2022 this is a serious level of hunger according to the Global Hunger Index. Afghanistan currently has the second-highest rate of disaster food uncertainty globally (Safi et al., 2024). Additionally, about 50% of Afghanistan's population needs emergency help (Melgar-Quinonez, 2023). Afghanistan is especially susceptible to the effects of climate change, mainly because agriculture, the country's main economic sector, is highly sensitive to these changes (Canton, 2021). Periods of battle, pervasive shortage, food insecurity, a heavy reliance on rain-fed cultivation on sparsely arable land, and delicate bionetworks all contribute to this vulnerability (Bais et al., 2018).

![Figure 10. One-Third of Afghan Population Facing Acute Food Insecurity](image)

*Source: Ariana News (2021)*
Health Affects

The nation’s natural and human systems will be under increasing stress due to the changing climate, making them more vulnerable to the effects of climate change (Baizayee et al., 2014). Because the natural disasters linked to climate change disrupt the variety of foods in meals, including fruits and vegetables, they exacerbate hunger and malnutrition in children. According to the Taliban’s Ministry of Public Health, malnutrition claimed the lives of almost 13,000 infants in 2022 alone (Zhang et al., 2022). In the upcoming decades, climate change in Afghanistan may also lead to a rise in the prevalence of illnesses associated with dust storms and poor air quality (Safi et al., 2024). By 2050, food insecurity is expected to cause 40.8 climate-related fatalities per million people in Afghanistan (Rocha, Cárdenas, Silva, & de Almeida, 2021). In Afghanistan, diarrheal illness is a major health concern for children. According to UNICEF estimates, diarrheal illness claimed the lives of almost 7,300 children under the age of five in 2016 (Pahmi & Endah, 2019). In Afghanistan, the effects of climate change are still felt in terms of human health, livelihood resources, and waterborne sicknesses (Savage et al., 2009). Children are impacted by climate change because it forces them to do tasks like firewood collection and small-scale animal herding (Miyan, 2015). Children and women are particularly susceptible to the socioeconomic effects of climate change (Goodman & Mahmood, 2019).

![Image of climate change impacts on health risk, vulnerability factors, climate-related hazards, and exposure]

**Figure 11. The Picture Shows Climate Change Impacts on Health Risk, Vulnerability Factors, Climate Related Hazards and Exposure**

**Source:** WHO (2023)

Methods

A comprehensive integrative literature search was used to have an in-depth understanding of the study using PubMed and Google Scholar databases to search key-terms “climate change” and “climate change impacts” “sustainable development” in Afghanistan. Using the RCP 2.6 (Low emission) and RCP 8.5 (High emission) scenarios, one of the World Bank’s assigned models (Ensemble) has been used to analyze temperature and precipitation. The reference list
of each article was also searched for additional articles. The literature search uncovered 80 articles published from 2002 to 2024.

**Sustainable Development Efforts and Challenges**

The goal of Afghanistan's sustainable development efforts is to tackle urgent environmental, social, and economic issues through a variety of programs. Future forced migration is expected to be largely caused by resource scarcity and climate-related catastrophes; estimates indicate that by 2050, these factors could compel 200 million people worldwide, millions of whom may come from Afghanistan to migrate (Safi et al., 2024). Food insecurity and persistent poverty are major concerns, with half of Afghanistan's population living below the national poverty threshold. By 2020, the government wants to bring down the percentage of people living in poverty from 54.5 percent in 2017 to 47.1%. That being said, 59.5 percent of people still experience food insecurity. To increase agricultural output, the government has made investments in water and livestock management, enhanced healthcare, and lowered the rate of maternal death. Afghanistan is a party to sixteen global environmental agreements and is impacted by climate change as well. On the other hand, the government has made investments in healthcare, water management, and livestock management in an effort to lower poverty rates and increase agricultural production (Mabry, Doctor, Khair, Abdelgalil, & Rashidian, 2024). Several groups, including the French NGO GERES, have developed cutting-edge solutions, one such option is Passive Solar Housing (PSH) technology, which dramatically lowers energy use and greenhouse gas emissions while enhancing thermal comfort. It has been demonstrated that the Passive Solar Housing (PSH) concept, which has a veranda to retain solar energy, can save 23% of energy and lower annual greenhouse gas emissions by 0.37 t\(\text{CO}_2\). Additionally, the technique lowers indoor temperatures by 1.43°C to 18.22°C. The saved emissions make up around half of the entire impact of mitigating climate change (François & Gavaldao, 2017).

In order to further promote environmental sustainability and fight climate change, Afghanistan has also participated in multilateral environmental agreements and created frameworks like the National Agricultural Development Framework (NADF) (Bowling & Zaidi, 2015). Afghanistan is utilizing various resources to tackle climate change contests, with the Global Environment Facility (GEF) leading the charge. The National Agricultural Development Framework (NADF) promotes environmental sustainability, while the National Environmental Protection Agency (NEPA) preserves the country's environmental integrity. An important component of Afghanistan's goal for sustainable development is institutional initiatives. Two of the main organizations in charge of preserving the nation's biodiversity and environmental integrity are the Ministry of Foreign Affairs and the National Environmental Protection Agency (NEPA) (Bowling & Zaidi, 2015). Additionally, universities make a substantial contribution by encouraging the creativity and invention necessary for advancement (Mohammadi, 2020).

Additionally, efforts are concentrated on particular industries including mining, agriculture, and renewable energy. Initiatives in the field of agricultural education seek to improve methods and increase food security, while community-based monitoring programs in the mining industry support economic development and the reduction of conflict (Rahimi, 2018; Sarhadi, Fahim, & Tangutan, 2014). Renewable energy initiatives help with post-conflict reconstruction efforts and are consistent with Sustainable Development Goal 7 (Slimankhil et al., 2020). Furthermore, in line with SDG 2 (Zero Hunger) and 13 (Climate Action), Afghanistan's efforts to address climate change through sustainable development concentrate on reducing temperature increases that affect grain crops (Sarwary et al., 2023).

Afghanistan's reforestation initiatives support community-based natural source managing and enhanced preservation plant sales outlet
techniques for sustainable development in an effort to fight poverty, insurgency, and environmental degradation (Groninger, 2012). By putting mechanisms for pollution management, biodiversity conservation, and environmental education into place, Afghanistan's recently passed Environment Act seeks to improve attempts at sustainable development in the country's forests (Wilson, 2006). In Paktika, Afghanistan, initiatives to manage groundwater sustainably involve educating the population, establishing integrated water resource management, and applying smart irrigation to address major issues and guarantee sustainability (Rahmani, Abi, & Azizi, 2022).

NGOs in Afghanistan concentrate on sustainable development to counteract the effects of climate change, targeting biodiversity, water resources, farming, and woodlands through policy lobbying and adaption techniques (Mehrad, 2020). In order to maintain sustainable water management, efforts are being made in Kabul to evaluate household water supplies, address groundwater depletion, address sewage pollution, and determine the necessity for additional water sources and wastewater treatment systems (Brati, Ishihara, & Higashi, 2019). Afghanistan's attempts to promote sustainable development center on increasing rice production through high-quality inputs, cutting-edge techniques, and government assistance in order to raise farmers' incomes and guarantee food security and self-sufficiency (K. Kakar et al., 2019).

Another top goal is addressing the issues surrounding the management of water resources. This includes developing intelligent aquifer systems for long-term water management and sustainable groundwater management (Karim & Sadat, 2021; Rahmani et al., 2022). Furthermore, in order to improve energy efficiency and remove implementation obstacles in residential building projects, sustainable construction approaches are being advocated (Shaker et al., 2022).

Nonetheless, a number of issues still exist, such as poor institutional capability, insufficient infrastructure, and unstable sociopolitical conditions. These obstacles impede development and need for all-encompassing approaches to enhance infrastructure construction, resource management, and resource consumption (Lei, Haitao, & Jinfan, 2018). Critical issues include water scarcity, agricultural vulnerability, and disasters brought on by climate change (Mehrad, 2020). Because climate change increases the dangers to health, it is necessary to take specific health interventions in addition to efforts to preserve the climate (Masood et al., 2022). However, there are substantial obstacles due to a lack of knowledge, ability, and resources for mitigating climate change (Akhtar & Shah, 2023). Sustainable development initiatives are further hampered by a lack of regulations, inadequate government ability, and insufficient awareness among builders (Shaker et al., 2022).

Inadequate ground data, inadequate irrigation infrastructure, and restricted access to technology are all problems in agriculture that are made worse by a lack of institutional support (Jami, Tasumi, Mosier, Somura, & Konishi, 2019; Saleem & Raouf, 2011). The perceptions of farmers, their plans for adaptation, and the gaps in policy make addressing these hurdles difficult (Sarwary, Senthilnathan, Saravanakumar, Arivelaras, & Manivasagam, 2021). Afghanistan's historical unrest makes sustainable development initiatives even more difficult, calling for well-informed talks and workshops with participation from academia and society (A. Kakar, Oral, & Saygın, 2020). Furthermore, issues like unlawful hunting, deforestation, and a lack of adequate law enforcement highlight the necessity of public awareness campaigns and international help (Saidajan, 2012).

In conclusion, Afghanistan's efforts towards sustainable development are diverse, involving a range of industries and programs meant to tackle difficult problems. Even though there have been great advancements, more work is still needed to get past challenges and establish long-term environmental, social, and economic sustainability.
Discussion

Afghanistan confronts a variety of opportunities and challenges in its quest of sustainable development, especially in light of climate change. On the one hand, the country's participation in multilateral environmental agreements demonstrates a commendable commitment to addressing global environmental difficulties and a desire to work together on common challenges. Furthermore, the creation of national frameworks and regulations like the National Agricultural Development Framework (NADF) and the most recent passing of the Environment Act represent an organized strategy for protecting environmental resources and advancing the protection of biodiversity.

Building resilience and guaranteeing long-term sustainability are strategically important, as seen by the government's large investments in vital fields including sustainable agriculture, renewable energy, livestock management, and water management. In addition to involving the local community, community-based programs, especially those related to mining and reforestation, also support economic growth and environmental stewardship.

Non-governmental organizations (NGOs) are essential in promoting sustainable development, influencing legislation, and putting adaptation plans into action to lessen the negative effects of climate change. Furthermore, a dedication to capacity building and innovation in sustainable development practices is seen in educational and research initiatives targeted at improving conservation strategies, sustainable construction methods, and agricultural practices. But in the middle of all of this, there are enormous obstacles. The implementation of sustainable development efforts in Afghanistan is impeded by institutional capacity limitations, limited infrastructure, and governance constraints. Stability and security are necessary for long-term prosperity, but persistent sociopolitical upheaval makes things more difficult. The effects of climate change are obvious and exacerbate pre-existing problems like food insecurity, agricultural fragility, and water scarcity. Growing sustainable development initiatives is hampered by a lack of technological...
and financial resources, which calls for international collaboration and support.

Furthermore, the urgent need for awareness campaigns and more robust law enforcement measures is highlighted by low public knowledge, unlawful actions including deforestation, and a lack of implementation of environmental legislation. To effectively address climate-related concerns in agriculture and other sectors, it is imperative to bridge policy divides, get a better knowledge of farmers' perspectives, and address gaps in adaptation planning. Notwithstanding these obstacles, Afghanistan's progress in promoting sustainable development initiatives demonstrates a commitment to creating a resilient, wealthy, and ecologically sustainable future. Achieving long-term environmental, social, and economic sustainability in Afghanistan will need significant efforts to fortify governance, increase climate change resilience, encourage community engagement, and develop capacity.

Conclusion

Afghanistan is at a turning point in its history where coordinated, immediate action is required to address the interconnected issues of environmental degradation, social instability, and climate change. The study thorough investigation shows how significantly climate change is affecting the population including industries, water resources, agriculture, biodiversity, and health. Afghanistan is among the countries most susceptible to the negative consequences of climate change because of its location and socio-political conditions, even though it makes up a very small portion of the world's greenhouse gas emissions.

The paper emphasizes the relationship between social resilience, economic growth, and environmental sustainability. Diverse tactics, such as investments in agriculture, renewable energy, water management, and forestry, are part of the effort towards sustainable development. In order to reduce the dangers associated with climate change, NGOs are essential in promoting legislative changes and putting adaption plans into action. But significant obstacles still stand in the way of sustainable growth, such as weak institutions, poor infrastructure, and unstable sociopolitical environments. To tackle these obstacles, all-encompassing strategies that give precedence to the development of capability, involvement of stakeholders, and global collaboration are necessary.

Furthermore, community involvement and public awareness initiatives are crucial for promoting environmental stewardship and resilience-building at the local level. Moreover, it is crucial to incorporate climate change adaptation into health interventions in order to lessen the negative effects of environmental hazards on health.

Afghanistan's dedication to sustainable development is demonstrated by its implementation of national frameworks and involvement in international environmental agreements, despite the challenges. In order to achieve SDGs by 2030 for Afghanistan; it is critical to implement the following recommendations.

Recommendations

To make climate resilience better and sustainable development, investments in climate resilience strategies should be priority, especially in sustainable agriculture, sustainable water resource management, and access to health care.

- Creating early warning systems, enhancing disaster preparedness, and putting nature-based solutions like afforestation and watershed management into practice.
- Research and innovation in climate adaption technology should be encouraged.
- Encouraging the use of climate-smart farming practices, like agroforestry, crop diversification, and effective irrigation systems.
- Implement policies that incorporate sustainable agriculture techniques and assist farmers can protect food production and lessen
the undesirable impacts of climate change on farming livelihoods.

- Institutional capacity is essential to solving climate change issues successfully. This can be achieved by developing the ability of local communities, non-governmental organizations, and governmental institutions as well as encouraging a culture of cooperation and information exchange among stakeholders.

- It is critical to give efforts that support localized energy production top priority, particularly in rural regions, in addition to increasing access to clean sources of energy like solar, wind, and hydroelectric power. Communities may lessen their dependency on fossil fuels, reduce greenhouse gas emissions, and enhance energy security by utilizing the potential of renewable energy technology. Furthermore, putting money into infrastructure for renewable energy can boost economic growth, open up new job possibilities, and help achieve sustainable development objectives. By encouraging equitable and sustainable development for all, we can expedite the shift to a low-carbon energy system and support renewable energy efforts at the grassroots and policy levels.

- Promoting climate awareness and environmental education is vital, in addition to fortifying healthcare systems to address the health implications, especially among vulnerable populations like women and children. This can support long-term sustainable development goals and create healthier, more resilient communities by funding health infrastructure and raising environmental knowledge.

- Fostering international cooperation is crucial to successfully tackling the world's climate change problem. Countries can pool resources, expertise, and best practices to conduct mitigation and adaptation activities by building alliances and cooperating with foreign organizations, donor agencies, and neighboring nations. To help efforts to combat climate change, this partnership may entail collecting money, offering technical support, and exchanging information.

- Insurance systems are crucial for farmers and other stakeholders to protect against risks, including climate change. Governments should intervene effectively by improving insurance accessibility, providing subsidies, and ensuring fair compensation.

- Afghanistan can improve its ability to withstand the effects of climate change, overcome current obstacles, and promote sustainable development for the benefit of both the present and the future by putting these ideas into practice in a comprehensive and integrated way.

Conflict of Interest
No Conflict of interest.

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