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Agriculture Land Use Degradation On Impact Poverty Threat To Human Food Security In KP, Pakistan

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Abstract
Agricultural land use degradation poses a significant threat to human security and poverty reduction efforts in Khyber Pakhtunkhwa (KP), Pakistan. This study examines the impact of land degradation on agricultural productivity and its subsequent effects on rural livelihoods. The region's dependence on agriculture makes it particularly vulnerable to land-use changes driven by urban expansion, deforestation, and unsustainable farming practices. These factors contribute to declining soil fertility, reduced crop yields, and heightened food insecurity, exacerbating poverty levels. The paper highlights the interconnectedness of environmental sustainability, agricultural productivity, and human well-being. It also explores policy interventions and sustainable land management strategies that can mitigate land degradation, enhance agricultural output, and promote socio-economic stability in KP. Addrsessing these challenges is crucial for ensuring food security, reducing poverty, and safeguarding human security in the region.

Keywords: Agricultural land degradation, agricultural productivity, poverty, human security, Khyber Pakhtunkhwa (KP), Pakistan.

Introduction
The agricultural land is a crucial factor in agricultural production, as it provides the physical space and resources needed for crop and livestock cultivation. Without land, it would be impossible to grow crops or raise animals on a large scale (Rondhi, Pratiwi et al. 2018). It contributes 26% to the gross domestic product (GDP) of the country (Chaiya, Sikandar et al. 2023). Furthermore, it involves 45% of the labor force and 67% of the population directly or indirectly

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depends on agricultural sector (e Saqib, Ahmad et al. 2016). According to the United Nations, the world's urban population is expected to grow by 2.5 billion by 2050, reaching a total of 6.3 billion people (Azadi, Keramati et al. 2018). Meanwhile, to the Food and Agriculture Organization (FAO) report from 2019, an estimated 925 million people, or approximately 14% of the world's population, (Mutesi and Madichie 2023) are experiencing food insecurity. Among these, 239 million, or 26%, are located in Sub-Saharan Africa (FAO 2010). Agricultural land threats to food security increasingly interesting equally issue (Tscharntke, Clough et al. 2012) The challenge of producing 70-100% more food to feed a growing population and UN declared the current decade (2011-2020) (Godfray, Beddington et al. 2010). The majority of poor people in the world live in developing countries, this is a complex issue of food and agricultural land degradation influenced by a variety of factors, including poverty, and limited economic opportunities (Hanning, O'Bryan et al. 2012). Agricultural policies can have a significant impact on food security in Pakistan, food supply and income, and the well-being of the poor and vulnerable populations in both rural and urban areas (Ahmad and Farooq 2010). However Farah, Khan et al. (2019) argued agricultural policies in Pakistan are not farmer-friendly, it can contribute to the massive conversion of agricultural land internal and external shock's development Regarding Pakistan, agriculture is one of the most vital sectors in its economy.

According to this importance of maximizing food conversion and reducing urbanization that causes loss of agricultural lands, biodiversity, soil erosions, and grazing (Shuaib, Ali et al. 2018) resource costs are important strategies for improving the efficiency and sustainability of agricultural production, need to be continuously available sources of food (Project Knowledge 2014). Feed the Future, launched in 2011, is a US government initiative that focuses on improving agricultural productivity and promoting food security in 19 target countries in, Asia, (Sitko and Jayne 2014) Agricultural land degradation is a major challenge that affects food security, environmental sustainability, and rural livelihoods around the world, including in Pakistan (Hossain, Krupnik et al. 2020).Furthermore, the world has experienced significant human fatalities and economic losses due to the increasing severity and frequency of natural disasters. In the study area, over 96% of households reported a loss of agricultural income and employment opportunities (Ahmad, Khurshid et al. 2024). However, to alleviate poverty, the government of Pakistan should subsidize farmers on environmentally friendly inputs. Additionally, establishing agricultural training

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schools would engage farmers in modern cultivation methods, while providing access to modern technologies at subsidized rates (Gambo, Roslan et al. 2024). As the population of Pakistan continues to grow, the pressure (Hassan, Shabbir et al. 2016) on land resources also increases agricultural land conversation (Arif and Khalid 2007) reducing agricultural production. In addition to food production, the land is also used such as providing materials and feedstock for the bio-based economy can help to reduce conflicts and promote sustainable agriculture land use practices that benefit all stakeholders (Mahmood, Iftikhar et al. 2016). While Socioeconomic factors, such as education, household income, and lifestyle, are closely linked to a family's awareness of poverty, human health, the significance of the quality of water they consume and implement the policy maker (Ahmad, Iqbal et al. 2021). Last but not the least, Currently, Pakistan is grappling with a severe food crisis driven by rapid population growth and an underdeveloped agricultural sector, similar to other developing economies. The population growth rate exceeds two percent in urban areas and ranges between two to three percent in rural regions. With the current population estimated at 200 million, projections indicate that it will double by 2050 (LÉVÊQUE, GODOYE et al. 2024, Saleem, Anwar et al. 2024).

However, reducing agricultural land conversion, (Jiang and Zhang 2016) only factor that contributes to this phenomenon converting their land to the non-agricultural forms of subsidies, grants, and loans uses. urbanization level from 56% in 2015 to 80% in 2050 (Wang, Bai et al. 2021) could potentially release 5.8 million hectares of rural land for agricultural production, which is equivalent to 4.1% of China's total cropland area in 2015. Alam (2018) Revealed that agricultural land values increase, prospective real estate developers may be tempted to build housing, and land areas. Agricultural land conversation and environmental impacts, including loss of productive farmland, (Azadi, Ho et al. 2011) reduced food security. Agricultural land conversion for non-agricultural purposes can lead to conflicts between farmers and non-farmers, (Milczarek-Andrzejewska, Zawalińska et al. 2018) and also have negative impacts, including the loss of biodiversity by agricultural land. Deregulation and DE bureaucratization policies can lead to massive rural land conversion (Hudalah and Firman 2012) the creation of gated communities, and new town development on the outskirts of major cities. Due to natural disasters many Pakistanis are leaving their hometowns, (Malik, Asmi et al. 2017) droughts, water shortages, frequent floods, earthquakes, and Cyclones, for non-agricultural land. while the families

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have lost their homes and have been shifted to big cities means non-production of agricultural land (Tariq, Zafar et al. 2018). Agricultural expansion and the intensification of human activities contribute significantly to land degradation (Hossain, Krupnik et al. 2020). Our assessment indicates that the government should prioritize the formulation of effective land use policies that protect the ecological environment and vegetation. Key strategies include enhancing cropland productivity (Bai, Wong et al. 2018), optimizing the utilization of cropland resources, and implementing sustainable reclamation practices. These measures are essential to achieve "Land Degradation Neutrality" and ensure the sustainable development of land resources in Pakistan (Peng, Zegen et al. 2023).Furthermore, there is an urgent need to develop and implement a comprehensive land use policy to protect agricultural land from the pressures of urbanization and industrialization. The adoption of a GIS-based Land Information System (LIS) for land use monitoring and decision-making can play a crucial role in safeguarding agricultural land by providing accurate data and supporting informed planning processes (Tahir and Khaliq 2018, Owusu Ansah 2022).

In 2016, the Government of Pakistan, in collaboration with the Oxford Poverty and Human Development Initiative (OPHI) and the United Nations Development Program (UNDP), conducted a comprehensive mapping and assessment of multidimensional poverty (Shakoor, Shah et al. 2024, Raza, Khan et al. 2025). It is essential to achieve Target 15.3 of the Sustainable Development Goals to attain land degradation neutrality (LDN) by 2030 at the national level (Koenig, Deenapanray et al. 2025). This study aims to identify key enablers, challenges, and benefits of LDN while proposing a new administrative management framework to mobilize private investments in alignment with local financial market conditions (Abbas, Guo et al. 2022). Although previous governments of Pakistan have introduced national policies for environmental protection, the environment remains highly vulnerable. Climate change continues to pose significant threats not only to citizens but also to livestock, agriculture, and the overall food web of the country (Chaudhry and Sciences 2022). Agricultural land into developed areas (Kocur-Bera and Pszenny 2020) for the spatial management crisis and poorly planned living spaces are permanent elements and, for this reason, they are the most difficult to eradicate and (Ustaoglu and Williams 2017) urbanization process, economic development, and social differences. In addition to the loss of agricultural land was direct and indirect, agriculture policy goal, and for what reasons, (Beckers, Poelmans et al. 2020) given

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the large amounts of public funds. The major reason for the mass migration and towns' growth had long-term negative consequences: and in surrounding agricultural areas (Rahman, Chandio et al. 2023). While the most reasons for families to purchase the housing plot large scale broken and build to homes and low land prices compared to non-agricultural production (Wasilewski and Krukowski 2004). Reasoned was growing population and urbanization have a significant impact on land use around the world, (Peerzado, Magsi et al. 2019) including Pakistan's agricultural land conversion in many areas.. Furthermore, While the humanitarian dimension of food insecurity is fundamentally intrinsic, this study evaluates the extent to which Pakistan has effectively addressed the challenges posed by food security (Fayyaz 2022).While extensive data exists on the varied impacts of climate change and natural disasters across different regions of the country, including district-level details, information on food insecurity remains largely confined to the provincial level. Additionally, significant gaps persist in the evidence base regarding specific population groups, particularly religious minorities (Farooq, Uzair et al. 2022). Meanwhile, Wheat is Pakistan's staple food crop, making it the central focus of the country's food security policy. Farmers cultivate wheat in winter and harvest it in summer. During the pre-flowering stage, cooler temperatures enhance the growth process, whereas high temperatures can slow seedling development and delay overall growth (Abbas, Kousar et al. 2022). Last but not the least, of Pakistan's comparative advantage in agriculture stems from its abundant natural resource endowment. The country benefits from fertile lands, diverse climatic conditions, and extensive river systems, particularly the Indus River, which supports irrigation and sustains agricultural productivity (Malik, Ali et al. 2016).

Impacts of Agricultural Land Non-agricultural developments, scattered were farmers operate on the (Baker, Everett et al. 2014) large-scale hazard, natural habitats, social impacts, cultural heritage and traditions, food security, degradation in the ALC area. (Bakoji, Elizabeth et al. 2020). However, urbanization remained the major threat challenging the sustainability of agricultural lands. (Jiang, Deng et al. 2013) socioeconomic factors can have a significant impact on agricultural land use intensity incomes rise. Agricultural land use and crop-specific fertilization and irrigation strategies impact both average incomes (Lehmann, Briner et al. 2013). Whereas, the policies of the Government of Pakistan have had a deep impact on the pace of urbanization in the conversion of agricultural land to urban use had negative impacts on agriculture and formers (WASEEM, FARHAT et al. 2019).

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unplanned housing schemes that are often built in response to the growing demand for urban housing can have adverse effects on both agricultural land degradation and urban development (Policy 2019). Migration is a common phenomenon observed in many parts of the world, its impacts were also observed in Pakistan (Chandio and Shirazi 2022).In addition, my Opinion: the impact of technological innovation (An, He et al. 2023) has increased the financial demand for agricultural land they can also improve productivity and profitability in the long run. Impacts urbanization, population pressure, (Naab, Dinye et al. 2013) and government strategies can all contribute to the encroachment of agricultural lands, which can have significant impacts on the livelihoods of rural communities. While this research examines the impact of climate change on food production and accessibility, with a focus on the most vulnerable populations in the country (Farooq, Uzair et al. 2022). It also explores potential adaptation and mitigation strategies, including the adoption of climate-resilient agricultural practices, efficient water management, and policy reforms, to strengthen food security in the face of climate change (Naz, Iqbal et al. 2024).

Furthermore, the climate security nexus in Pakistan is analyzed using a deductive approach through the perspectives of environmental security and political ecology (Ruhi, Muhumuza et al. 2025). This study plays a vital role in informing policy-making processes by offering insights into climate change mitigation, conflict-sensitive adaptation strategies, and enhancing societal resilience (Saad, Mahsud et al. 2024). last but not the least, Food security remains a critical challenge in developing countries like Pakistan. Although Pakistan is self-sufficient in major food crops, ranking 8th in wheat production, 10th in rice, and 11th in maize, it still faces significant food security issues (Yang and Tian 2024, Huang, Peng et al. 2025). Despite these achievements, the country ranks 78th globally in terms of food security (Nozimakhon, Ergasheva et al. 2024). Approximately 43% of the population, predominantly women, experience food insecurity due to limited access to food. Additionally, 15% of children under the age of five suffer from acute malnutrition, while 44% face stunted growth (Béné, Bakker et al. 2021, Aryal, Manchanda et al. 2022, Shahid 2023). While Pakistan is geographically located in a region where the impacts of climate change are profoundly significant and increasingly severe (Hashmi, Belgacem et al. 2021). The concept of national security holds significant importance, and in recent years, food scarcity in Pakistan has been on the rise due to a combination of worsening

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climatic conditions and inefficient resource management and production (Fatima and Sciences 2024).

Urbanization, human migration, population growth, (Parveen, Ghaffar et al. 2019) and anthropogenic activities all contribute to agricultural land changes and land use the degradation of ecosystems. The major contributing factors of urbanization in Pakistan are a combination of internal migration, and real estate development without approval (Zaman 2012). Agricultural land conversion revealed Naveed, Khan et al. (2019) refers to the process of converting farmland into non-agricultural uses such as urban developments-economic, family structure, and income from agricultural land. (Quasem 2011) Non-agricultural uses (such a high rate of adaptation will not only be harmful to agricultural production but will have an adverse impact on food security). It is important to note that population growth is not the only factor (Islam, Jannat et al. 2020) contributing to agricultural land conversion. However, Agriculture, with improved productivity, has the potential to play a vital role in future economic development, food security, livelihood enhancement, and poverty reduction (Yaohong, Firdaus et al. 2025). However, the sector in Pakistan is confronted with significant challenges related to water scarcity, land degradation, and socio-economic constraints (Aslam 2016). The food crisis driven by the climate crisis is reshaping societal behavior and weakening nation-building efforts in recent times. Intensifying climate change is heightening agricultural vulnerability (Akhtar, Jan et al. 2023). Pakistan possesses the world's largest integrated irrigation system; however, water scarcity has forced farmers to transition from water-intensive crops such as rice, wheat, cotton, and sugarcane to less water-demanding crops and vegetables. This shift has intensified pressure on the food market (Hashmi, Belgacem et al. 2021).While Agricultural land degradation poses a significant threat to human security in Pakistan. Additionally, domestic, industrial, and agricultural activities have contributed to the deterioration of water quality, poverty, leading to serious health-related concerns (Aslam, Gul et al. 2021). Meanwhile, Immediate action from district and provincial governments is essential to protect households from the adverse effects of poverty and food insecurity. The conversion of agricultural land leads to the loss of income sources, resulting in unemployment and increased food insecurity among rural communities (Saqib, Yaseen et al. 2024). Furthermore, the recently introduced National Security Policy of Pakistan (2022-2026) reflects a transformative shift in the country's national security agenda (Arslan, Ilyas et al. 2025). Adopting a more people-centric approach, the policy envisions that "the

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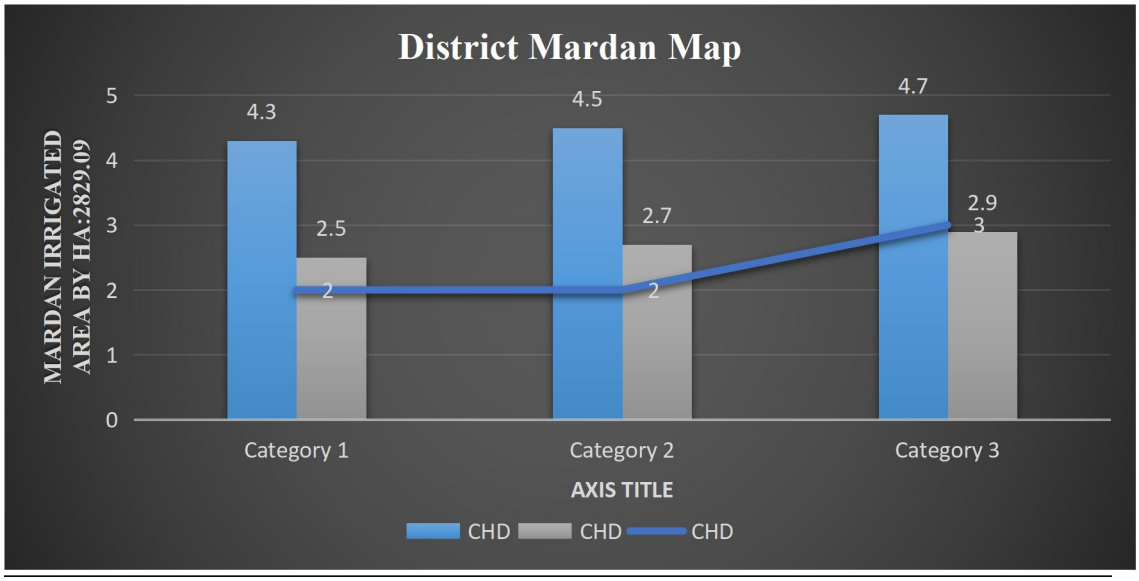
security of Pakistan rests in the security of its citizens." (Fayyaz 2022) In this context, food security, as a critical aspect of human security, is increasingly being recognized as a national security concern, directly influencing state development and progress (World Health Organization) (Organization 2025). however, Food insecurity in Pakistan is significantly higher in mountainous regions compared to the plains, primarily due to a combination of biophysical and socioeconomic factors (Ferré Gras 2023). Furthermore, Pakistan's economy is heavily dependent on agriculture, yet water scarcity poses significant challenges, leading to economic losses, rapid urbanization, and various socioeconomic issues (Adnan, Xiao et al. 2024). Last but not the least, the continuous conversion of fertile agricultural land into built-up areas is diminishing food production capacity and reducing livelihood opportunities linked to agriculture. Despite being an agricultural country with vast fertile land, Pakistan faces significant challenges in preserving its arable resources (Rehman and Khan 2022).

Research Area

Moreover, specific geographical coordinates for Mardan. Based on the coordinates you provided, Mardan is located between approximately 71.8° to 72.5° east longitude and 34.05° to 34.32° north latitude. As you mentioned, Mardan is situated in the central region of Khyber Pakhtunkhwa. However, the overall population of the Mardan district is 2.1 million people and it covers an area of 1,632 square kilometers, then the population density of the district would be approximately 1,286 people per square kilometer, not 888.5/sq km as I previously mentioned.(Chaiya, Sikandar et al. 2023) Meanwhile, use statistical measure 76% of the agricultural land and 75% has a good irrigation system.



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Materials and Methods

Study Area

This study's main objective the based on the information you have given me, I agree that your study can be classified as an explanatory form of research, as it aims to identify the cause-and-effect relationship between the dependent variable (conversion of fertile land to non-agricultural purposes) and various independent variables (socio-economic, demographic and environmental factors). I also approve that the survey research design is an appropriate method for your study, as it allows you to collect detailed data from households through a well-structured questionnaire. Your questionnaire appears to cover a wide range of variables, both the general socio-economic conditions of the farmer and specific information regarding the study. It is also clear that your unit of analysis will be both farmers who have converted their agricultural land and farmers who have not. This approach will allow you to compare and contrast the characteristics of these two groups, and identify the main factors that contribute to the conversion of agricultural land

Conclusion

Agricultural land use degradation poses a significant threat to poverty levels and food security in Khyber Pakhtunkhwa (KP), Pakistan. The loss of fertile land due to uncontrolled urban expansion, deforestation, soil erosion, and unsustainable farming practices has led to decreased agricultural productivity, directly affecting rural livelihoods. Many farming communities, heavily dependent on agriculture for income and sustenance, face increasing challenges in accessing food and maintaining economic stability. Furthermore, the degradation of agricultural land exacerbates poverty by limiting employment opportunities and reducing the availability of essential food supplies. This, in turn, contributes to malnutrition, food shortages, and socio-economic instability in the region. Immediate policy interventions, such as sustainable land management practices, improved irrigation systems, reforestation programs, and strict urban planning regulations, are essential to mitigate these adverse effects.

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Massive growth in population and rural to urban migration has led to the rapid urbanisation of major cities in Pakistan. This blog presents how urbanisation in Pakistan is systematically different from that of the traditional model. The significance of the agriculture sector of Pakistan is also explained

along with the impacts of urbanisation on the agricultural industry. Lastly, the blog gives suggestions to uplift the agricultural sector to maximise its potential and efficiency for sustainable growth

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