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The Effects of Land Insecurity on Food and Nutritional Security in Pakistan

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Abstract: *In Pakistan, extensive land degradation, affecting three-fourths of the nation's land, poses a severe threat to food and nutrition security. Current global population is 9.7 billion and projected population to reach 9.7 billion in 2050. Land degradation, which includes issues like waterlogging, salinity, and erosion, has damaged approximately 68 million hectares nationwide, significantly impacting food production, nutritional value, and human health. Malnutrition, especially in children, remains a critical concern, underscoring the need for sustainable solutions such as bio-saline agriculture and diversified, nutritious crop cultivation to address the complex interplay between land degradation and nutrition security. This study aims to assess the current state of land degradation and its implications for food and nutrition security in Pakistan and examine the concept and causes of land insecurity in Pakistan. This research based on secondary data and published research paper, the main theme of this paper is that to investigate status of land degradation, food security and nutrition in Pakistan. Need sustainable multi-sectoral action for soil restoration, soil health, reducing stunting, and secure long-term food and nutrition security with strengthening agriculture sector. A shift toward diversified, nutrition-sensitive, and climate-resilient agriculture supported by soil health restoration, biosaline farming, and strengthened extension services is essential for sustainable food security and reduced land degradation.*

Introduction

A crucial element of the nation's socioeconomic development and human capital is food and nutrition security. Pakistan is a developing nation that is vulnerable in terms of nutrition security. It is ranked 92nd out of 116 nations according to the significant level of hunger index with a score of 24.7: Low (≤9.9) extremely alarming (50.0), Serious (20 -34.9), alarming (35.0–49.9), and Moderate (10.0–19.9) (Global Hunger Index, 2021). According to the Provincial statistics of Pakistan, 30percent of children in Punjab,

47percent of children in KPK, 40 percent of children in Balochistan, and 50percent of children stunted in Sindh province (NNS, 2018). Even though land degradation is a continuous problem around the world, it is particularly significant in Pakistan, where three-fourths of the nation's land is currently vulnerable (UNEP, 2021). The primary factors contributing to soil deterioration in Pakistan include salinization (05 ha), waterlogged soil (6.17 ha), sea intrusion (annual sea level rise of 1.3 mm), poor soil nutrients (0.3percent), erosion by water (16–18 ha), and erosion by wind (3-5 ha). The yield of the food produced, and its nutritional value ultimately has adverse impact on human health and nutritional security. Approximately 854 million people worldwide experience food insecurity as a result of declining crop yields and agronomic production, and low protein and micronutrient concentrations (such as Zn, Fe, Se, B, and I) exacerbate undernourishment and hidden hunger, that impacted 2 billion people in 2020 and similar numbers estimated as recently as 2024, especially children (Laal, 2019; Freeland et al., 2023).

A significant problem today is meeting the need for food and nutrition security on a worldwide scale. High-yielding cultivars, irrigation, artificial fertilizer, and synthetic pesticides are characteristics of conventional farming, which emphasize boosting yields rather than the nutritional value of the food. However, many agro-ecosystems use pesticides and chemical fertilizers excessively, farming frequently held responsible for environmental pollution, food shortages, and land deterioration. Utilizing an organic supply of nutrients to create nutritious food, restore soil fertility, and reduce climate change is a sustainable way to provide nutritional security. Regarding the utilization of organic vs inorganic sources of nutrients, there are several misconceptions and debates (Timsina, 2018).

Although food production has significantly increased in recent years, food insecurity and malnutrition persist in Pakistan. Women, children, and the elderly among those with the lowest incomes are the most susceptible, and they are severely to moderately malnourished, as stated in "Vision 2030" by Pakistan's Planning Commission (Khan and Shah, 2021). To combat malnutrition in Pakistan, numerous actions attempted. It was the biggest crisis Pakistan has ever faced, gravely affecting about 2 billion publics (Amanat, 2021).

Since a few years ago, Pakistan has been a country with an excess of food, as opposed to one where 36.9percent of the population experiences nutritional insecurity. This primarily caused by land degradation, the nutritional value of crops, and the nutritional capacity of the land (National Nutrition Survey, 2018). However, Pakistan continues to experience nutritional insecurity and must address significant obstacles to the implementation of policies like sustainable land management, climate-smart agriculture, and agriculture focused on dietary needs.

Land is essential for sustaining life on earth and attaining sustainable development goals because it offers a variety of goods and services that benefit both humans and the environment (Keesstra et al., 2016). By regulating the carbon and nitrogen biogeochemical cycles, it provides crucial health, socio-economic, and ecosystem services like a reservoir and groundwater purifier, food production, a major carrier for biodiversity, and a climate buffer (Adhikari & Hartemink, 2016; Brevik et al., 2015; Steffan et al., 2018).The organic component of the soil, in particular, is essential for securing these activities (Du et al., 2009). However, during the past few decades, more and more hints of expanding land degradation have emerged (IPCC, 2019). According to some authors (DeLong et al., 2015; Olsson et al., 2019), land degradation is a "global pandemic" that affects 1.3 to 3.2 billion individuals. Globally, the arable land according to people has been steadily decreasing since the 1990s (Gomiero, 2016). Various studies have estimated that between 15percent and 80percent of the world's agricultural land is currently degraded (Bindraban et al., 2012; Gibbs & Salmon, 2015).

Objectives of Study

- To assess the current state of land degradation and its implications for food and nutrition security in Pakistan
- To examine the concept and causes of land insecurity in Pakistan

Methodology

This research based on secondary data and published research paper, the main theme of this paper is that to investigate status of land degradation, food security and nutrition in Pakistan.

Population Status

Population- Global perspective

Under specific assumptions, the United States Population Reference Bureau's (PRB) 2020 forecast of the world's demographics. The world's fifth most populous nation as of 2025 is Pakistan. Prior rankings for Pakistan were 10th in 1991, 7th in 1998, and 6th in 2015. The country's economic development as well as its natural riches would hamper by the country's slow population increase. Land resource pressure from the population results in land fragmentation, food security, and nutrition security. In 2050, the projected global population is 9.7 billion, up 35 percent, with an increase in the need for agricultural products like food, fiber, feed, and fuel. However, there is a lot of strain on the world's land. With so much attention being paid to food security, the globe is moving toward nutritional instability, which results in human health disorders, rising healthcare costs, rising family expenses, and an increase in poverty.

Table 1. Ten most populous countries, 2025 to 2050.

S. No	Country	Population Mid 2025 (millions)	Rate of Natural Increase (percent)	Population Mid 2035 (million)	Projected Population Mid-2050 (millions)
01	India	1476.6	1.4	1576.3	1663.0
02	China	140.4	0.3	1423.6	1366.1
03	USA	349.0	0.3	361.8	385.7
04	Indonesia	287.8	1.2	307.7	328.7
05	Pakistan	259.2	2.2	287.2	347.8
06	Nigeria	242.4	2.5	295.0	401.3
007	Brazil	213.5	0.8	229.2	232.9
08	Bangladesh	177.8	1.6	196.9	215.5
09	Mexico	132.9	1.2	141.9	148.2
10	Japan	126.0	-0.4	123.6	109.9

Sources: United Nations Population Division, *World Population Prospects* (2025–2050 projections).

Population- Pakistan Perspective

The average yearly growth rate of the population was determined using the data from the decennial Census. 2.45 percent in 1961, a high of 3.69 percent in 1972, and a subsequent decline to 2.40 percent in the 2017 Census (PRB, 2024). Rural growth followed the general pattern whereas urban growth has been dropping. The percentage of population share in rural areas has been declining while that of urban areas has been rising, which is consistent with the anticipated demographic change.

Land Degradation Status

Land degradation- Global perspective

The 02 billion acres of land and 1.5 billion people around the world have been affected by land

degradation. Every year, erosion destroys 24 billion tons of productive soil. According to the data, 12 million hectares of land are lost per year, which equals 23 hectares every minute (FAO, 2021). A sustainable land management strategy is urgently needed in this dangerous situation (GEF, 2021). According to UNEP, 70 percent of dry land and about 30 percent of the earth's land sustains one-sixth of the global population, have been damaged by land degradation and desertification. Within Asia's context, the dry land (22 percent) is affected. In comparison to developed nations; developing nations experience dangerous obstacles to securing adequate nutrition due to land degradation (SLMP-II, 2017).

Land degradation-Pakistan perspective

Pakistan's land has suffered greatly from land degradation and desertification in terms of agricultural production, food security, and nutrition security. Approximately 68 million hectares of sensitive land are affected by land degradation nationwide. 80 percent of Pakistan's land is arid or semi-arid, making it a country with limited water resources. Agro-pastoral activities are the key source of earnings for two-thirds of the population (SLMP-II, 2017). Water and land are examples of natural resources that can be degraded. Several interconnected economic, social, and environmental problems related to land degradation have been brought on by an expanding population and the demand for additional food, fodder, and fuelwood.

Desertification is an outcome of various natural and human-made factors, including drought, overgrazing, excessive water, and land use, over-cultivation of marginal lands, deforestation, soil erosion, waterlogging, and salinity, as well as the use of unsuitable agricultural practices like excessive chemical and irrigation water use (Wang et al., 2023). This has the effect of adoption. of croplands that have deteriorated in Pakistan include those that are waterlogged and salinized, abandoned villages, conventional irrigation systems, croplands that have become dry due to degraded groundwater aquifers or a decline in the water table, siltation of rivers, irrigation systems, and reservoirs, and landslides in hilly areas (IPCC, 2019). Desertification lowers agricultural output and increases poverty. Additionally, it significantly reduces the amount of carbon stored in soils, which contributes to global warming and biodiversity loss. Regarding the land and its nutritional content, the nutritional worth of the crop, and nutritional diseases among Pakistani citizens, it is a very dangerous challenge.

Key factors of land degradation

The following are the main causes of Pakistan's desertification due to land degradation:

Soil salinity

Salinity, which is caused by excessive concentrations of salt in the soil, is one of the toughest environmental conditions that limit the production of crop plants that are susceptible to salinity, as claimed by Kumar et al. (2018). Both industrialized and developing nations around the world, including China, India, Pakistan, the United States of America, and others, struggle with salinity issues (Zaman et al., 2018). Around 14 percent of the irrigated land was found to have soil salinity, according to Batool et al. (2014). Presently, 20 percent of agricultural land is affected by soil salinity, posing a danger to not just food security but also nutrition security and environmental deterioration. A severe pandemic of nutrition security will be brought on by the nation's excessive growth of 4 percent. In Sindh province, where agriculture contributes to the second-largest portion of the country's GDP, 2.5 million ha of arable land is threatened by salt cover (Ennaji et al., 2018). Typically, salt moves from upstream to downstream locations, which may be the main cause of Sindh province's worsening salinity issue. Salinity and waterlogging are mostly caused by the significant rise in the water table in sizable portions of Punjab, Sindh, KPK, and Baluchistan. The size of the issue can be estimated from the fact that, according to Batool et al. (2014), the amount of fertile land was losing 40000 hectares per year to salt.

Waterlogging

Worldwide, 16 percent of agricultural land has affected by waterlogging, which is a serious issue in the United States, China, Russia, Pakistan, and India (Shaheen et al., 2021). According to Zhang et al. (2016) and Jia et al. (2019), the main abiotic stress is responsible for the severe stagnation of crop output, food security, and nutrition security. It is brought on by several things, including thick soil texture, excessive irrigation, excessive rainfall, and seepage of water through canals. Flooding kills plants because it hurts the root system's ability to support shoot growth. Waterlogging occurs when soil is so saturated with water that the root system cannot be aerated as a result of the high-water content. Due to the excessive humidity and hypoxic circumstances, the soil in this disorder becomes unproductive and sterile. According to Pucciariello et al. (2019), it is not necessarily necessary for the groundwater level to reach the crop root zone for these circumstances to arise. When the groundwater table and the crop root zone are connected, even capillary pressures can support this process, making things worse by fostering anaerobic conditions (Rasheed et al., 2018). 25 percent of Pakistan's irrigated land is impacted by salinity and waterlogging. The Government of Pakistan (2007) estimates that roughly 02 million ha of land has been impacted by waterlogging, with 0.8 million ha in Punjab and 1.1 million ha in Sindh. After 11 years of agricultural expansion, 6.17 million ha have been damaged by temporary flooding or permanent waterlogging, and 1.16 million ha of land are threatened by salinity and waterlogging problems at the same time (Dollinger and Jose, 2018). The country has gone astray 5.16 million ha of useful land for 11 years, which is essential for ensuring food and nutrition security, making it the great economic depression in Pakistan.

Wind erosion

Strong air currents can cause erosion by the wind in areas with finer materials or dry, barren sands. The Thar, Thal, Cholistan, and Kharan are large sandy deserts that are prominent wind erosion hotspots. Western Baluchistan's silty or finer valley floors and terraces are also susceptible to wind erosion. Wind erosion causes 28 percent of all soil loss in Pakistan, significantly affecting 3-5 million acres of land.

Table No: 02 Areas affected by wind erosion.

Wind Erosion	Area (million ha)
Light	3.998
Moderate	6.742
Total	10.740

Source: National Action Programme for Combat Desertification. *National Report on Desertification and Land Degradation in Pakistan*. Government of Pakistan

Wind erosion has harmed 10.7 million ha in total. According to a recent survey on land usage in Pakistan, range land is thought to be in poor condition in over 90 percent of cases, and in 5 percent of cases maybe. Pakistan has experienced a dramatic rise in moderate to severe erosion during the past 09 years, an increase of 1806 percent. Wind erosion has grown 174 percent more generally. When developing a plan for the next 15 years, this extremely worrying condition needs to be tackled as one of the top priorities.

Loss of soil fertility

The Global Assessment of Soil Degradation (GLASOD) reports that Pakistan's "light fertility decline" only affects 5.2 million ha or 20 percent of its total land. Soil degradation is mostly caused by accelerated erosion. In most cases, soil loss and soil production are balanced. Unfortunately, a lot of

inefficient farming and logging practices promote erosion. Due to the unbalanced application of fertilizers and the extraction of vital plant nutrients from soils under intense farming, Pakistan is constantly experiencing a loss of soil fertility.

Sea intrusion

In many coastal regions across the world, seawater intrusion is a significant problem that is mostly brought on by the overuse of freshwater resources, climate change, and sea level rise (1.3 mm annually). As a result, seawater intrusion extends several kilometers inland, contaminating and rendering unusable freshwater supplies. In coastal places, seawater infiltration is a constant issue. It has huge potential to destroy the environment, which could further affect people's quality of life and way of life.

The earlier work made it evident that the various segments within a coastal civilization affected differently by the decline in downstream flow. For instance, the rapid seawater intrusion has had a detrimental influence on the agricultural fields, leaving the cultivated areas in a barren state and having a considerable negative impact on the food grain harvests in the area (Magsi et al., 2017). According to Solangi et al. (2019), the Indus Delta's 42,607 hectares of land have damaged by surface seawater intrusion. As a result, over the previous 45 years, tidal flood plains have grown by 7.1percent.

Food and nutrition security- Global perspective

Food security indicators – latest updates and progress towards ending hunger and ensuring food security:

In 2020, despite the COVID-19 epidemic, the number of hunger populations increased globally worldwide increased. The Pou (Prevalence of Undernourishment) grew from 8.4 percent to roughly 9.9 percent between 2019 and 2020, increasing the difficulty of meeting the Zero-Hunger objective in 2030 after maintaining essentially stable from 2014 to 2019. Depending on the assumptions used to reflect the assessment's uncertainty, the 2020 projection can be anywhere between 9.2 and 10.4 percent. Demographic projections indicate that in 2020, there will be between 720 and 811 million hungry individuals worldwide. Based on the median of the predicted range (768 million), projections range from 70 to 161 million, indicating that 118 million more people experienced hunger in 2020 than in 2019. More than half (418 million) of the 768 million undernourished people worldwide will live in Asia, followed by more than one-third (282 million) in Africa, and only roughly 8 percent (60 million) will reside in Latin America and the Caribbean. The number of hungry people increased by 46 million in Africa, 57 million in Asia, and 14 million in Latin America and the Caribbean in 2020 (FAO, 2021).

Nutrition indicators – latest updates and progress towards global nutrition targets

According to SDG Indicator 2.1.1, in the year 2020, 149.2 million (22.0 percent) children under five globally suffered from stunting. The prevalence of stunting has decreased; it was 33.1 percent in 2000, 26.2 percent in 2012, and 22.0 percent in 2020. Nearly 70 percent of the world's stunted children lived in only two locations: Central and Southern Asia (37 percent) and sub-Saharan Africa (37 percent). In 2020, there were 45.4 million (6.7 percent) wasted children under five. More than half of the population lived in Southern Asia, the subregion with the highest prevalence of wasting (almost 14 percent). Nearly a quarter lived in sub-Saharan Africa. The frequency of adult obesity has increased globally, rising from 11.7 percent in 2012 to 13.1 percent in 2016. Between 2012 and 2016, the prevalence of adult obesity increased throughout all subregions, and they are all currently falling short of the 2025 World Health Assembly goal to reverse the trend by that year. One in seven infants, or 20.5 million, or 14.6 percent of all live births in 2015, were underweight at birth. (FAO, 2021). In the same year, 38.9 million kids under

the age of five were overweight, or around 5.7 percent. Little has changed globally in the last 20 years, as seen by the difference between 5.7 percent in 2020 and 5.4 percent in 2000, but trends in various settings and locations are on the rise.

Food and nutrition security- Pakistan perspective

A key aspect of food security from the standpoint of public well-being is consumption, absorption, and food usage. This metric is dependent on the nutrient content of the meal and the amount of energy needed by a healthy person (Arif, 2007). In addition to having enough energy in the form of digestible food, adequate food supplies must also meet several additional requirements, including having enough fiber, vitamins, and macro- and micronutrients. Most Pakistanis are undernourished, consuming fewer calories than required for a healthy lifestyle. The average daily calorie intake in Pakistan is 2,360 Kcal per person, which is a bit more than the 2,350 Kcal ceiling set by the National Planning Commission as the daily need (GoP, 2014). However, as 44 percent of the population consumes less than the recommended daily intake of 2,350 Kcal per adult equivalent, this does not imply that everyone consumes equally. In FATA, where 69 percent of the population consumes less than 2,350 Kcal per adult equivalent per day, the lowest calorie intake is found. Balochistan (68percent) and KP (49 percent), followed by AJK (55 percent) and Sindh (51 percent) and GB (63 percent) in this region. In contrast to the national average, Punjab (37 percent) and ICT (32 percent) have lower percentages of people who consume less than their daily calories need. Dietary diversity is scarce in Pakistan, especially among the poor and marginalized who follow a set diet and eat from a tiny selection of items.

Malnutrition Status

Malnutrition entails inadequate nutrition. Both a lack of food consumption and a lack of nutrient-dense food consumption are major contributing factors. A person's intake of energy and/or macro- and micronutrients might be deficient, excessive, or unbalanced, which leads to malnutrition. Malnutrition frequently results from a lack of access to food. Asia witnessed a global decline from 38 percent to 23 percent between 2000 and 2017, and as a result, it is now thought to have the highest rate (UNICEF, 2018). The biggest number of stunted children worldwide, according to Development Initiative-2018's Global Nutrition Report, is found in India (46.6 million), followed by Nigeria (13.9 million), and Pakistan (10.7 million). The Global Committee on Food Security has classified malnutrition into several subcategories, including micronutrient deficiencies, hunger, undernutrition, overweight, and obesity. This is a major problem for both developing and rich nations.

In Pakistan, four out of ten children under the age of five have stunted growth, and 17.7 percent are withering away. The prevalence of overweight people (9.5 percent) and children (28.9 percent) is increasing, indicating a double burden of malnutrition. who are underweight in the same age group. In children under the age of five, the prevalence of overweight has increased from 5 percent in 2011 to 9.5 percent in 2018.

Table-03: Children's health status by province

Region	Stunting	Wasting	Severe Wasting
Punjab	39.2	13.7	4.8
Sindh	49.8	17.5	6.6
KP	47.8	17.3	8.7
Balochistan	52.2	16.1	7.0
FATA	57.6	10.0	5.8
AJK	31.7	17.6	6.9
Gilgit	50.6	6.8	2.7

Source: Ministry of Planning, Development & Reform, UNICEF, and Agha Khan University. 2022. National Nutrition Survey (NNS) 2018.

The National Nutrition Survey 2018 indicates that Pakistan is dealing with a severe malnutrition epidemic, one of the worst in the world that has not improved in decades. Acute malnutrition affects 15percent of children under five, which is the highest percentage in South Asia. Furthermore, according to WHO standards, 10 million children under the age of five, or 43.7percent of all children, are chronically underweight or "stunted." Stunting rates in Pakistan have alarmingly increased from 36.3 percent in 1994 to 41.6 percent in 2001. Stunting is more common in rural settings (46.3 percent) than in metropolitan centers (369 percent). Stunting rates reach their highest point in FATA, where 57.6 percent of children are stunted. Balochistan, GB, and Sindh follow with over half of all children stunted (MPDR, 2012). Pakistani children under the age of five suffer from severe nutritional deficits. According to the 2011 National Nutrition Survey, 61.9 percent of kids are iron, 54.1 percent vitamin A, 40 percent vitamin D, and 39.2 percent zinc deficient. For example, iron deficiency that results in anemia is a common form of malnutrition among women of reproductive age (MPDR, 2012). This stunts kid growth and has an impact on fetal growth.

Table-04: Vitamin and mineral deficiencies among children

Deficiency Type	Percentage
Iron deficiency anemia	61.9 percent
Vitamin A deficiency	54.1 percent
Vitamin D deficiency	40.0 percent
Zinc deficiency	39.2 percent

Source: Ministry of Planning, Development & Reform, UNICEF, and National Nutrition Survey (NNS) 2018

A household's education level is associated with nutritional consumption and good hygienic habits. The low overall literacy rate of Pakistan (58 percent) and the even lower female literacy rate (47 percent) (GoP 2018) are both due to gender. Since women often choose and prepare the majority of the household's meals in Pakistan, this presents unique nutritional concerns.

Snapshot of national nutrition survey in Pakistan

In 2018, the Pakistani government estimated that 44 percent of children stunted, with slightly more males (48 percent) than females (42 percent) affected (Bhutta et al., 2011). According to estimates from a linear mixed-effect model on child growth and malnutrition, stunting in Pakistan gradually declined from around 70 percent in 1977 to 38 percent in 2018 (UNICEF, et al., 2019). Important health indicators and information on the nation's nutritional status gathered as part of the Demographic and Health Survey (2017–2018 PDHS) (NIPS et al., 2018). According to statistics, the rate of stunting in children has gradually decreased from 45 percent in 2012–2013 to 38 percent in 2017–2018, a difference of roughly 17 percent. In a similar vein, the proportion of youngsters who were underweight and wasted decreased from 30 percent to 23 percent and from 11 percent to 7 percent, respectively. Because of childhood stunting, Pakistan loses GDP every year. According to McGovern et al. (2017) and Fenn et al. (2015), every rupee spent on combating malnutrition will return 16 rupees in benefits. In Pakistan, the rate of childhood stunting has dropped from 45 percent in 2012–2013 to 38 percent or 40.2 percent in 2017–2018, a relatively slow fall of barely 0.5 percent. For example, Zambruni et al. (2019) report that Peru successfully used a variety of interventions to reduce child stunting by 50 percent in just seven years (2007-2014). The issue of malnutrition and stunting can be resolved in Pakistan with the implementation of appropriate intervention programs and policies.

Conclusion

In conclusion, Pakistan's slow reduction in stunting reflects the limitations of uni-sectoral policies in addressing complex nutritional challenges. A strong multi-sectoral approach, integrating agriculture and health, is essential to improve food quality and availability. Sustainable soil management and climate-resilient farming practices can enhance crop productivity and micronutrient content. Ultimately, restoring soil health is key to achieving long-term food security and reducing malnutrition.

Policy recommendation

Pakistan shifts from major-crop dominance toward diversified and nutrient-rich crop production through targeted subsidies and market incentives. Biosaline agriculture should be promoted in salt-affected regions, particularly in Sindh, using adaptive research and farmer capacity building. In addition, agricultural policies should align with SDGs 2, 3, 12, and 15 by strengthening sustainable land management, climate-smart agriculture, and soil health-focused extension services.

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