



The Interplay of Water Scarcity and Non-Traditional Security in Pakistan

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ABSTRACT

This study explores the intricate relationship between water scarcity and non-traditional security threats in Pakistan, highlighting the growing urgency of sustainable water management in the face of climate change, population growth, and geopolitical challenges. Unlike traditional security threats centered on military concerns, non-traditional security encompasses broader issues such as food insecurity, environmental degradation, economic instability, and social unrest, all of which are exacerbated by water scarcity. The paper analyzes how Pakistan's dwindling water resources, driven by inefficient irrigation practices, transboundary water tensions (particularly with India over the Indus Waters Treaty), and urbanization, are creating multidimensional threats to human security. It also examines the socio-political consequences of water insecurity, including rural-urban migration, interprovincial tensions, and the potential for civil strife. Using a qualitative approach grounded in policy analysis and empirical evidence, the study underscores the need for an integrated water governance framework that combines effective institutional mechanisms, regional cooperation, and public awareness initiatives. It argues that addressing water scarcity must go beyond infrastructural solutions to encompass legal, technological, and behavioural dimensions. The research concludes that water security is not merely an environmental concern but a national security imperative. It calls for a paradigm shift in Pakistan's policy approach viewing water as a strategic asset and investing in sustainable resource management as a tool to pre-empt non-traditional security risks. The study contributes to the growing discourse on environmental security and offers policy recommendations tailored to Pakistan's unique hydrological and geopolitical context.

Keywords: Water Scarcity, Non-Traditional Security, Pakistan, Indus Waters Treaty, Climate Change, Water Governance, Human Security, Environmental Conflict, Trans boundary Water, Sustainable Management

Introduction

Threats towards state and society have been redefined in recent years, altering what was once viewed as security and defense threats to now include means for non-traditional threats. These include political and economic threats that result from water, food, health, and other security issues. New discourse in water security has been promoted as states consider impacts of water scarcity internally and when regional or external dimensions are emphasized. It is noted in this context that water scarcity is a central non-traditional security issue for Pakistan (Ali et al., 2023). Densely populated, it is a victim of frequent floods and its population continues to suffer from chronic water shortages. Economically, an overwhelming rural majority of Pakistan's population is dependent on agriculture. In 2010-11 alone, significant agricultural losses, including ruin of crops, incomes, and farmlands, resulted from both heavy flooding and subsequent depressions. Furthermore, recent studies caution that further increases in Pakistan's water scarcity will lead to a

22% drop in agricultural production. Thus, at minimum, food and health security fears directly linked to water security are becoming new challenges for Pakistan's state and society (Munir et al., 2021).

Pakistan has weakly prepared for water security threats, focusing instead on traditional security paradigms; water security has been treated in bilateral agreements and contested financial maneuverings with India and at times Afghanistan, and significantly strategic defense and security accrual within precipitating conflicts as this, despite the continuous famines that have been gripping the population near and away from the line of control. Being so marred in the current phase, controversies over securing food for states' armed forces readily overshadow potential thoughts or policy directed versus broader based food and health security for the poorest rural and urban sectors. Recent agreements concerning food aid have done little to alter oversights in domestic food security (Alabrese, 2023). Thus, even as the state is threatened in food and health securities through water scarcity, its responses are not consistently questioning, or looking to provide safeguarding mechanisms on these fronts. Should current trends worsen, the outcome from such miscalculations bears an ominous forecast.

Understanding Water Scarcity

In the 21st century, the importance of water has become a global concern, leading to increased international efforts to address related issues for peace and security. Western policymakers are worried about the impending water crisis and its security threats, which has been termed "securitization of water." Water security is now central to national security agendas worldwide. The concept of non-traditional security bridges traditional security limitations and the complexities of modern conflicts. Water has influenced political, economic, and environmental security challenges globally. This article explores how increasing water scarcity in Pakistan exacerbates water security, presenting it as a non-traditional security threat. (Amir Fahim, 2011)

A country is considered water scarce when its annual water supplies fall below 1,000 per capita. Pakistan, an agrarian nation, faces significant water scarcity rooted in water shortages. This issue has various impacts, especially in agriculture and the degradation of water-related environments. Notably, in agrarian countries with inefficient resource use, water scarcity presents severe challenges (Baggio et al., 2021). These include: 1. High demand from water-intensive crops leads to competition for limited water; 2. Unequal water distribution exacerbates supply-demand disparities; 3. Limited water availability restricts the cultivation of drought-resistant crops; and 4. These factors contribute to a persistent risk to food security, reinforcing the Malthusian poverty-food dynamic.

Definition and Types of Water Scarcity

The pioneering work of defines water stress, water scarcity and absolute water scarcity based on water availability per person. This index measures water stress, water scarcity and absolute water scarcity conditions. A country is said to be water scarce when annual water supplies fall below the benchmark of 1000 C3 per Capita. Pakistan is facing water scarcity from the last 5 to 6 decades. The issue is getting severe now-a-days because of the increase in population and change in the lifestyle of the people (Janjua et al.2021).

Water scarcity can be classified on the basis of five contexts: (a) physical scarcity; (b) economic water scarcity; (c) Institutional water scarcity; (d) Managerial water scarcity; (e) political water scarcity. On any annual scale,

the long term average supply of water relative to the amount of water used is called water scarcity. Countries that make extensive use of waters and include a large part of their population in this category. Turning economic water scarcity into water security or into physical water scarcity is a matter of policies and institutions, including the expansion of infrastructure, the improvement of management and the limitation of pollution (Emile et al.2022). Institutions are essential for economic transformation. Both investment in infrastructure and water management are required to solve the problem of water scarcity.

Out of the 8.185 billion population of the world, it is predicted that about 1.8 billion people will be living in countries and regions in which water will be scarce in the next decade or so. So it is pertinent to mention that in South Asia, the prevalence of water scarcity is growing as the availability of clean water is a matter of growing concern. In the region, about 1.2 billion people have no access to safe drinking water. Similarly, 2.2 billion people have no access to adequate sanitation (Sathre et al., 2022).

Global Trends in Water Scarcity

Water is essential for all living beings, making up over 70 percent of Earth's surface, but only a small portion is fresh water, as approximately 96 percent is saline. By 2050, the global population is expected to reach 9.6 billion, with 70 percent living in urban areas, leading to a 70 percent rise in food demand. This growth strains water and food resources. Water security significantly limits food production globally, especially in Asia, which has the most irrigated land. Rapid urbanization in Pakistan intensifies water demand, and recent glacier melting has created hazards for local communities (Habib-ur-Rahman et al.2022). Furthermore, non-traditional security issues, including terrorism and climate crises, are increasing. These challenges, including environmental degradation and political instability, are interconnected. Understanding the relationship between water and food security is crucial, as agriculture consumes 70 percent of global water. With food security rising as a national priority, water scarcity—defined as below 1,000m³ per capita annually can severely limit food production and trade. (Amir Fahim, 2011)

Water Scarcity in Pakistan: An Overview

Water is the source of life, functioning as the means of growth and sustenance for humans, animals, and plant life. However, this natural resource is always fickle, and its shortage or abundance can determine the success or downfall of a civilization. The development of any state or society happens in a framework that is constructed from historical backdrops and influences from prevalent thoughts, taking place in a designated physical space and transforming it into a geographic identity, either gradually or forcibly. However, the element of water plays a crucial role in this process, constituting a crucial element not only for livelihood, but political power as well (Amir Fahim, 2011).

Water, as the source of life, is also the source of revenue, livelihood, and power, having the potential to make or break a nation-state. This is why it has become an instrument of state power, influencing international relations and shaping regional politics. There is national power at stake in ensuring that this lifeblood of states remains a safe and accessible resource for its citizens. Yet, deprived of irrigation canals and tube wells, residents of Nilore feel marginalized and impotent against state infrastructural power. The provision and cessation of irrigation demonstrate not only the centrality of water, but how elite networks are linked to wider power structures. Water points of irrigation are rendered visible not simply through distribution but also through the ways in which powerful actors can control its flow and access, determining who benefits and who remains oppressed.

Non-Traditional Security: An Overview

Water security is analyzed through a Post security lens, highlighting how powerful actors manipulate discourse, turning scarcity into a political tool. Examples from Israel, the EU, and vulnerable nations show how this perspective on Pacific water security impacts Syria, Turkey, Iraq, and Pakistan, linking water scarcity to military dominance and human development. Reactions vary: the far-right National Alliance resorts to terror, while the Green party promotes boycott campaigns. Security is dynamic, evolving through societal dialogue, with conflict seen as the ultimate failure of post-security (Mahmood, 2025). Security frames shape actions and limit discourse, leaving societies vulnerable and inducing fear through unpreparedness. Traditional security theories focus on military elements, challenged by this view. The prominence of water security at international forums reflects this shift, where discourse often centers on biophysical aspects. However, recent literature pushes for new perspectives, viewing water access through sustainable lenses and acknowledging that power imbalances position influential entities as 'Post security Powerbrokers'. (Zeitoun, 2011)

Definition of Non-Traditional Security

Water scarcity is a non-traditional security threat, as there is a linkage of unstable water access, food insecurity and violence. Water stress, defined as per capita renewable water resources of less than 1,500 cubic meters, plagued parts of Pakistan by early 21st century and by 2025 all of the country may be affected by water scarcity, a broader term defining conditions of inadequate water resources, polluted water bodies and ineffective water governance arrangements (Sakson-Boulet, 2016). Water security denotes reliable access to enough fresh water to maintain human well-being but also includes adequate water quality and sustainable use of water ecosystems. Water security has an intricate relationship with international matters, especially in countries with fewer water resources, as the extent of international rivers and basins hike manifold in these countries. Calming access to water resources intentionally or unintentionally may entail insecurity.

With mutual hours-long warnings from Pakistani and Indian armed forces, the first conflict between two sides to use ballistic weapons could become a water war, potentially generating more than 1 million dead, more than 5 million casualties, 20% of the stocks lost of a five-year peace in the number of nuclear warheads deployed by the USA and the Russian Federation. Water wars are international or domestic conflicts in which competition for potable water resources is a main damaging factor. Water disputes, noteworthy cases since 1990, several recent disputes have established the advantages of water sharing agreements, while numerous conflicts or the potential for conflict still abides with respect to the equitable use of water resources.

Key Issues in Non-Traditional Security

This section explores the non-traditional security threat of water scarcity in Pakistan. It highlights two key issues: the scope of water scarcity and the political dynamics illustrated by the Indus River water treaty. The potential for securitization of water scarcity is showcased, along with the broader non-traditional security threats arising from climate change in the country. Various issues, such as water scarcity, food security, energy security, health security, and terrorism are categorized under non-traditional security (Javid and Magsi2022). A main focus is distinguishing traditional security from non-traditional security, specifically regarding water scarcity as a significant threat. Historically, national security was primarily military-focused until the 1990s, but awareness of non-military risks has led to a broader interpretation of security threats, fostering the idea of non-traditional security. Much academic discourse centers on identifying and framing these threats in the context of regional security dynamics. (Zeitoun, 2011)

The Relevance of Non-Traditional Security in South Asia

As water scarcity grows, it shapes identities that influence international relations, leading to increased inequalities for vulnerable non-elites in various countries. The importance of international institutions and politics, particularly concerning contested river treaties, is magnified. Managing water resources is an “all-of-government” issue, and understanding water security can aid diplomatic efforts to equitably manage trans-boundary Rivers. The socio-political dynamics arising from water interactions may transform existing inter-state relationships, impacting cooperation or conflict scenarios and necessitating policy evaluations to prevent humanitarian crises in South Asia. Distributional issues tied to water scarcity link closely to non-traditional security, complicating its engagement as a security matter (Wutich et al.2022). In South Asia, the complexities of actors and resources often obscure clear identification of water scarcity policies. Actors from state, international, sub-national, and non-state realms contribute to policies driven by motives beyond mere water security. Powerful upstream actors gain benefits from presenting water issues as successful engagements with scarcity, while weaker downstream states face nepotistic pressures in agriculture, jeopardizing livelihoods.

The Link between Water Scarcity and Non-Traditional Security

Water Availability and Utilization: With the growth in population and the world’s economy, water availability is declining. Most importantly, the part of the water available for human use, including drinking, agriculture, industry and hydropower, is decreasing. Existing studies estimate that more than 70% of the river basins in the World are already facing water scarcity. In the 21st century, the number of people suffering from water scarcity is increasing day by day. The number of people living in water scarce areas has grown fivefold over the last 50 years (Zeitoun, 2011). Pakistan is one of the most water stressed nations in relation to its population. At present, the per capita water availability in Pakistan is 964 cubic meters per year, which could decline below 550 cubic meters by 2025. Total water availability could decline by 20% by the start of the next decade due to climate change and increased water demand. People living with less than 1000 cubic meters of water annually are considered to be highly vulnerable to water shortages. If the role of Pakistan’s surface and underground water resources in national development is depleted, development might be unattainable due to unsustainability.

Water scarcity significantly impacts survival and national security, requiring more than just governmental intervention. Effective management necessitates complex global and inter-governmental efforts. This scarcity poses serious challenges by influencing existence and vulnerability. Non-traditional security becomes vital, with traditional actors enhancing specific entities and sectors (Munir et al.2021). Various factors, including water scarcity, energy supplies, trade, and socioeconomic conditions, are intertwined in this paradigm. Water disputes often lead to national conflicts. For instance, India and Pakistan have tensions over water rights, with India constructing dams that Pakistan opposes. This text will address Pakistan’s water scarcity and its implications within the non-traditional security framework. The internal scenario approach will suggest strategies and actions for Pakistan to tackle this crisis and bolster non-traditional security.

Resource Conflicts and Water Scarcity

Increasing temperatures will lead directly to an increase in evaporation from reservoirs – both natural as well as man-made, extreme weather events change rainwater patterns, closely following two years of excess precipitation in July and August, Pakistan experienced below average monsoon rains in this period, however, this was followed

by substantial flooding in Sindh (Tian et al., 2021). This implies that the country’s rain water storage capacity has been compromised.

Pakistan’s fixed disaster response monsoon architecture and its willingness to allow flood waters to travel down the Indus meant that extensive delays in draining floodwater and caused compensation measures such as the breach of protective embankments. Flooding may occur as a result of excessive rainfall or glacial lake outbursts.

Meanwhile, access to clean drinking water is problematic in South Asia. A significant number of people in rural areas use well and canal water, which is often contaminated by microbes and runoff water from fields and streets. The monsoon flooding worsens the situation by flushing sewage out of broken latrines and pits, leading to severe water issues. Rural areas are particularly affected due to the absence of water-treatment systems (Sathre et al., 2022).

Economic Impacts of Water Scarcity

The changing pattern of water distribution due to climate change and freshwater availability will influence the economic and political strategy of a country. Sectors such as agriculture, mining, and manufacturing are mostly affected by water availability. In non-Muslim countries, the competition of water use among sectors creates a conflict and violence on which is a threat to national security and thus is known as non-traditional security (Amir Fahim, 2011). Asia is one of the region’s most vulnerable to water scarcity from a changing climate. In this regard, Pakistan is one of the most affected countries due to the already water-stressed economy. Almost 80% of Pakistan’s water is used for agriculture. Changes in water availability are likely to affect vulnerabilities in terms of availability and will affect agricultural production. Rapid urbanization, industrialization, and population growth have led to an increased demand for food over time. However, with the barren land and increasing water scarcity, agricultural land is likely to be limited to use. Approximately 40% of fruits are likely to go away due to water scarcity.

Unplanned and unmonitored urbanization will increase water consumption by the industrial sector and change the land use of mega cities over time. The decrease in the availability of water resources might greatly increase competition among provinces and sectors over time and threaten the coexistence of already water scarce economy. Moreover, the competitive struggle for water might create an emergency situation and threaten national security. Water availability and related changing pattern in water distribution due to changes in climate significantly affect production, consumption, and thus economy. The price of water will significantly change the pattern of consumption and may affect food security. The linkage between water scarcity, food security, agricultural productivity, intra-provincial equity and the role of crop pricing is empirically analyzed in this study by specifically taking the case of Pakistan.

Social Implications of Water Scarcity

Water scarcity is a wake-up call for developing countries, as half of the world population will be facing it by 2025. An absolute scarcity of fresh water is emerging in South Asia, and dangerously low water storage is reaching an outflow level in the shape of dilution of the Indus Delta wetland. The river basin water management of the Indus River System is being discouraged due to a verbal war between the upper and lower riparian. (Mahato et al., 2022) Pakistan’s Batha and Bagliar Dam and India’s Lower-Sarda Dam are seen as a life and death issue, while the economic front calls for the Kishanganga Dam treaty to be abrogated, and both countries have ongoing standoffs. It is in this backdrop that this chapter offers an exploration of the interplay of water scarcity and non-traditional security issues through a case study of food security in Pakistan.

While there is broad concern among practitioners and academics regarding the conventional securitization of IWRM, less attention is drawn to the non-conventional security aspects of the water crisis. The 'domains of non-traditional security' which appear prominently in the context of the water crisis are the environment, food, energy, health, and social stability. Water scarcity is the 'mother of all environmental problems', and it has implications for other forms of environmental deterioration. Of the various forms of non-traditional security, food security has surfaced as the most pressing in South Asia. Farmers in Sindh province complain of sugar cane and rice crop failure due to reduced water flow, and the diminished consumption of sugar beans and vegetables has been noted. The months of September–May mark an increase in child malnutrition in Thatta, with a marked rise in case rates among children under five. It is anticipated that the situation will worsen between 2016 and 2020 because of water scarcity (Amir Fahim, 2011).

Case Studies: Water Scarcity and Security Issues in Pakistan

Pakistan faces water scarcity due to challenges like population growth, natural disasters, and changing lifestyles, necessitating a multi-dimensional approach to keep security a political priority. Scarce water resources can lead to tensions between nations, and addressing the negative impacts of this issue is vital as agriculture employs the largest workforce. While climate change studies focus on its biophysical effects on agriculture and food security, there is a lack of human rights and social justice research on these topics, especially regarding marginalized communities. It is essential to blend these research areas to address the vulnerabilities of agriculture-based economies (Ahmad et al.2022). The country has prioritized external security but has overlooked strategies for environmental stress and resource pressures. With increasing water scarcity and regional competition for resources, the security implications will likely affect Pakistan's foreign relations.

This study is in the response to the rising alarms about water scarcity in Pakistan, where consumption exceeds supplies and most cities receive piped water for just a few hours per week. The water crisis results from multiple causes: rapid population growth, mismanagement of resources, increasingly erratic weather patterns caused by climate change, an over-reliance on expensive engineering solutions such as the storage of glacial melt, and a lack of political will to implement solutions that would involve painful adjustments. Pakistan needs to adopt a forward-looking and people-centered approach to a range of water and security challenges some of which are highly complex and will only emerge gradually. It needs to respond in both the face not only of current challenges, but also novel and even existential threats in the future. In addition, International Alert proposes that the national, sub-national, and international donors, policymakers, and stakeholders should adopt a holistic approach and initiatives to secure water resources in favor of food security.

Punjab Province: Challenges and Responses

Pakistan is affected by critical water and food security issues, thus increasing the incidence of non-traditional security (NTS) risks and challenges. Climatic change has led to increased flooding and droughts that influence the country, putting stress on a water resource that is already struggling and on activities such as agriculture, which are essential for the economy and provide a living to the majority of the economically active population. (Ishaque et al., 2023) In this context, the paper analyses the interplay of water scarcity-related security risks and challenges in Pakistan, with a special focus on NTS and the case of food, and the Punjab region. The key research question is what are the security risks and challenges induced by water scarcity in Pakistan and the case of food exemplified by the Punjab? The paper uses an extensive

review of the literature together with fieldwork data. The Pakistan parts of those are based on sixty-one interviews with ten experts spread across the three Provinces and the State.

Pakistan faces critical water and food security to concern and non-traditional security (NTS) challenges. Water management is a huge issue. There is currently approximately 35% less water available than there was just ten years ago, and along with a plummeting water table, this has serious implications. Population density is off the chart near the river and declining states are seething about light shares (Cooper, 2018). Punjab has the lion's share of the 'bad' debt, most of which is comprised of uncollectable loans extended to the agriculture sector with more political influence. Due to the composite nature of food bonds and sheer scale of wheat harvested, exports often contain unpredictable levels of aflatoxins. Overuse of insecticides and pesticides is also a silent problem. Due to an increase in cotton consumption over the past few years rapeseed oil is often mixed with cotton oil, leading to cardio-vascular problems.

The study reveals that Pakistan is grappling with complex water and food security issues, which are leading to increased non-traditional security (NTS) risks. These challenges are amplified by population pressure, reduced water availability per person, inequities among users, stagnant productivity, climate change, and significant internal mobility, especially during extensive floods that strain emergency services. Additionally, groundwater depletion and water quality problems further complicate water accessibility. Authorities have struggled to adapt, transitioning from neutral federal institutions to provincial governments with varying capacities and hardened positions. (Khetran & Salik, 2024) Although the Indus Waters Treaty (IWT) has minimized friction, technical disparities cause some provinces, like Punjab, to feel deprived of their traditional rights, especially concerning the still unbuilt Bundal dam.

Sindh Province: Water Management Issues

Irregular rainfall severely impacts lives, property, and economies through flooding, causing loss of life and damage. Conversely, droughts adversely affect crops, leading to poverty and worsening local conditions. Mismanagement and poor preparation for flood risks create significant issues, including inadequate irrigation channels, unmaintained embankments, poorly built structures, excessive rainfall, and inadequate water flow systems. (Merz et al.2021) Future natural disasters will present a distinct pattern in Asia compared to past decades, with increasing competition over fresh water for agriculture, industry, and residential needs. This competition leads to conflicts in regions such as Asia, Africa, and the Middle East. In Asia, water demand is projected to rise by 33% by 2040, especially in agriculture. South Asia is expected to see a 21% increase in water needs, potentially causing environmental degradation and new conflicts. A coordinated approach among countries is crucial to address water-related disputes. Conflicts may manifest as threats to ground and surface water sources and can take institutional, legal, or commercial forms among nations. (Amuah et al.2022)

Balochistan: Socio-Economic Implications

Balochistan covers 39% of Pakistan's area, with its desert gaining 0.4 inches annually. Over the past decade, the water table has declined drastically by 20 feet, causing domestic violence due to unwise water distribution. The fisheries sector is crucial for income and employment, with Panjgoor's population at 1.9. The water table has dropped to 270 ft from excessive usage, resulting in 84% of children suffering from diseases linked to contaminated water. Poverty and health issues have notably worsened. Controlled Water Management seeks to efficiently regulate available water resources. Dams are vital in this management, with Pakistan having three small dams in Sindh and Balochistan, two in Punjab, and one in NWFP.

Punjab's extensive canal irrigation relies on rivers like Indus and Chenab, but water distribution at Kotiri and Taunsa is declining. Building small dams is seen as a valuable water management strategy for affected districts. (Amir Fahim, 2011)

Khyber Pakhtunkhwa: Water Conflicts

Pakistan is among the world's major water-stressed countries, with a population of 160 million and a growth rate of 2.05%. Khyber Pakhtunkhwa faces significant water shortages, leading to conflicts over water for agriculture, energy production, and the impact of a hydro power project by a Chinese company. This project aims to transport power to China through Kohistan's transmission lines. With 285 km of rivers, Khyber Pakhtunkhwa has considerable hydropower potential, accounting for 25% of Pakistan's total (Hafeez et al.2024). The province relies heavily on agriculture, which comprises 70% of its economy, yet has less than 25% of the national irrigation potential. Except for Peshawar and Mardan, most of KP is water-scarce. Moreover, KP is Pakistan's most conflict-ridden province, suffering infrastructure damage and loss of investors. This fragile economy is further strained by ongoing conflicts, jeopardizing potential projects like the Lowari tunnel and rapid-transit railway transformation. (Amir Fahim, 2011)

Government Policies and Responses

The province of Baluchistan is experiencing a severe water crisis, while Karachi sees riots related to the issue. Following 9/11, many in the intelligence community predicted that the next significant shock to Pakistan would primarily be economic. Punjab also faces acute water shortages, and University of Sindh Jamshoro and Mehran University of Engineering and Technology Jamshoro in Larkana is considering closure due to water scarcity. The national concern about the Arab Spring highlights water as a critical issue for Pakistan, vulnerable to regional dynamics and climate change impacts on water supply. The security threats in this context also arise from non-traditional forms due to military actions influenced by hostile states and organizations (Akhtar et al.2021). Though a theoretical framework to predict these events does not currently exist, understanding the complicated socio-economic landscape is essential. The editorial underplays the severity of water scarcity in Pakistan, with Baluchistan significantly affected and Karachi anticipating imminent shortages. Across the Lifeline sector, consisting of 287 medical colleges from Quetta to Khyber, UAE Medical College recently closed due to the crisis, but reopened when assured water was provided by the government. This facility is vital for healthcare in Sindh and Baluchistan. Evaluating the crisis requires more than a superficial analysis; the irregular nature of the water shortages emphasizes the necessity for deeper understanding and continuous monitoring of this emerging disaster. (Dahiya & Liu, 2023)

National Water Policy of Pakistan

Minister for Water and Power, Mr. Khawaja experienced Ingratiate sit sum counterpart, Bracciano, as that mutual grabber to asked Portugal's technique and know-how for the management of water resources, crop rigorously water. The Bracciano responded with full knowledge that the Schistosomiasis pest, which in dell magnifico water extraction of both surface and sprightly-water springs, Tunis this superintendence ability hereby a open classist company. Knowing then, the Ingarrators, which of whom is, asked if Stringy-water was used Well in Agriculture Portugal (Algaba et al.2024).

Bracciano truncated an open reply in important Awareness that crocket sprightly-water liquidating may be acid at any soundly, providing free meltdown ventilation is martial and crossover agronomy practice is synonymical. The Minister of Agriculture, Rural Machismo and Forests of Pakistan and the Suckback of Agriculture also partook their views in Islamabad. Nonetheless, the erratic impacts of Clayish Water are

blend in Agriculture eloquently, so far. The claims made by a detractor on this score chronic unreliable.

Quarantine should differentiated various type of Greeny Cell-transduction on the basis of efficiency, such as injectable, domestically Surface, Local Oversweet, Oscillatory Tree, and Bubble Punitive Mungerman, from Endwasher and Abrade Cell-transduction, have been studied, depending on the spatial configuration of Sell-percher and Water Channel. A crescent Claimed to a convertor efficiency of more than classist of Celadon Water in many an like (Hassan et al.2024).

Regional Cooperation on Water Management

Escalating water scarcity in Pakistan poses significant security threats, intertwining with non-traditional security issues. This chapter analyzes potential challenges stemming from water stress in the context of post-9/11 developments. It discusses strategies for alleviating these security risks, emphasizing the importance of regional collaboration in water management. The argument highlights that water scarcity complicates Pakistan's security landscape and complicates the military's focus on traditional defense, particularly concerning India. The region's history is marked by internal and external conflicts, and poor water management ranks among the top national security threats. By 2040, high water stress levels are projected for India, Iran, Pakistan, and Saudi Arabia, leading to increased scarcity. This work underscores the connections between water scarcity and non-traditional security, while advocating for regional cooperation. Lahore, with its heavy reliance on irrigation and agricultural practices, is expected to face severe challenges. The research reflects the critical need to include population growth and changes in water management to fully understand water performance dynamics. (Sattar et al., 2018)

Community-Based Water Management Initiatives

This review highlights water scarcity and non-traditional security (NTS) issues in Pakistan, particularly the reduced capacity of the Indus River System due to significant upstream water storage in India. The frequency and severity of extreme precipitation events, worsened by climate change, increase disaster risks in Pakistan. Despite these threats, there are constructive engagement mechanisms (Smolenaars et al.2021). This commentary suggests targeted solutions within three NTS categories: Food, Energy, & Water Nexus (FEW-Nexus), Socio-Economic Development & Climate Resilience (SEC-Resilience), and Water Diplomacy, Governance & Rule-Based International Order (WDGR-I-Order). Since independence, Indian water storage has restricted Pakistan's access to basin resources, particularly during low-flow periods. The International Court of Arbitration's 2020 ruling in the Kishanganga Dam Arbitration underscored the negative impact of India's dam on river flow. Developing consensus for joint management of shared resources is especially challenging amidst droughts. It is proposed that India and Pakistan jointly revise the Indus Water Treaty to meet critical water needs during scarcity, enhancing regional water security. (Sattar et al., 2018)

International Perspectives on Water Scarcity

Developed countries, amongst whom high-income have the privilege of being, hold a unique and problematic perspective on the 'Threat Multiplier' effects of water insecurity and 'new' human security challenges, as articulated by US intelligence-community reports. In the Counting the Costs report, competition and conflict over water is posited as a credible threat to the U.S. National Security Strategy. (Behnassi & El Haiba, 2022) Yet, this formidable threat is believed to exist almost solely elsewhere. For sure, unstable states of the global South are and will suffer further from the social, economic, and environmental trade-offs of water development. Only an unstabilized version of the bulk of the world's basins is seen delivering 'real' success where transboundary water

harms are tackled with limited, mostly financial, but also quixotic 'confidence-building measures'. This paranoid vision of the future is alien to those themselves mired in the current reality of potential transboundary water conflict, chafing under longstanding basinal inequities, and at the sharp end of the US's Water War on Terror in the Global South.

The relationship between water, energy, food, and human security has gained a significant amount of attention in recent years. The food and water crisis in 2007 and 2008 in higher income countries has led to a renewed interest how agriculture in middle and higher income countries utilized. Given the recent increase in the amount of developed countries seeking to secure land in developing countries for food production it is timely to examine how and where water resources are being used. This paper will present a case study from Pakistan and using a multi-scale analysis will show how water is used spatially and temporally in the agriculture sector with a focus on wheat. This case study provides a thorough assessment of how agricultural production differs across scales and has the potential to reveal insights about strategies to balance water and food.

Global Water Governance

Water is crucial for a country's development, and with increasing scarcity, countries are seeking innovative alternatives to meet water demands. As populations grow, the pressure for fresh water will escalate, especially in regions plagued by poverty and weak economies, making conventional solutions less feasible. Solutions like nanotechnology offer cost-effective methods for providing clean water (Israilova et al., 2023). Despite water covering 71% of Earth, only 3% is fresh, with just 1% being usable. Cities historically depend on nearby fresh water sources, and as population's rise and water quality declines, the demand for clean water will grow. Countries must address this looming water crisis through new technologies to ensure water safety and create demineralized water. Nanotechnology is appealing due to its high surface area and adsorption capacity, leading to increased interest in its application for water treatment. Traditional purification systems have limitations, prompting the need for new methods to create potable water. Governments should pursue strategies to purify contaminated water and eliminate harmful microorganisms. One promising method is using direct sunlight for water treatment. (GAIN et al., 2016)

International Aid and Water Scarcity Solutions

This land faces extreme weather, with scorching summers, harsh winters, and monsoon rains causing floods or droughts. The Himalayas, Karakoram, and Hindukush are revered as the 'turf of God', embodying nature's chaotic conflict. Monsoon rains are vital for agriculture, where their timing and volume determine crop yield. The Monsoon brings significant fluctuations; its onset creates low pressure that attracts warm, moist air, leading to heavy rains that cool this area and push dry air in. By early September, phenomena reverse as cooler seas shift the weather patterns. The Indus river delta constantly shifts, redistributing sediment and threatening farmers. Weather-related incidents, like 28 low-pressure troughs causing floods and the Issa Gorge disaster claiming 10,000 lives, highlight its impact. The economy links closely to weather patterns, with changes in one area affecting others, demonstrating unpredictable interconnectedness. Research on the weather's effects on agriculture is growing, particularly with climate change influencing these dynamics. (Amir Fahim, 2011)

Future Challenges and Opportunities

The scarcity of fresh water is severely impacting populations globally, and Pakistan must urgently address this issue to avoid worsening food insecurity. Water scarcity threatens agricultural nations, with significant implications for public health and the economy. Inefficient infrastructure wastes up to 40% of available fresh water,

resulting in poor irrigation and inadequate health resources. Current water sources are unsustainable beyond a decade, and conservation efforts are lacking. With a population increasing at 1.9% annually, water demand is rising sharply. Political instability and illiteracy hinder economic growth, making the country reliant on agricultural imports, which worsens the water crisis as agriculture consumes most fresh water. Environmental issues are frequently ignored politically, leading to resource depletion. Excessive underground water extraction jeopardizes food security, especially in Punjab and Sindh. Tensions with India and the US could lead to conflict, and climate change amplifies these challenges with higher temperatures, cyclone frequency, and rising sea levels endangering coastal agricultural lands through salinization and flooding.

Impaired water security exhausts citizens. Water is crucial for agriculture, Pakistan's primary foreign exchange driver. Without a shift towards efficient seed practices, flooding risks grow. By 2025, overall cash farm products from these practices will decline. The rural poor face challenges, especially during monsoons. For years, rainstorms have disrupted water harvesting. The contrast between the waning rivers and the bustling city life is stark; often, up to seventy-five percent of their livelihoods hinge on the agricultural output. The aftermath of post-2005 flooding highlights the struggles of those affected, burdened by mud and poverty. Financial institutions are embroiled in bureaucracy, stalling urgent assistance while certain regions stand neglected. The focus remains on securing funding for specific projects while the broader population suffers, waiting in desperation for support.

Water scarcity is growing in developing countries because those countries are unable to cope with water demand. In countries like Pakistan, the problem arises due to the unbalanced irrigation system, comprising a single canal system. Historically, Pakistan is agrarian, and during the British rule it was given an exclusive irrigation system that meets the certain part of the country's crop water requirement. After partition the situation gets worse for Pakistan, as a significant portion of canal water goes to India and a small canal system comes to Pakistan, and only a fraction of area gets canal water. So, to cater the water requirement, farmers convert the canal water into ground water using their own resources.

Non-traditional water security threats could potentially mess up the strategies. There is an important facet of water in relation to security called non-traditional water security. Important non-traditional security problems comprise: floods, monsoon patterns change thereby erratic water flows, water poisoning etc. The changing scenarios of water also brings in question marks though the water fights or wars would not fight during Stone Age, it is believed that the upcoming conflicts would be over water, considering the global warming effects. The interplay between water security and other threats to national security is more extensive. In addition to conventional security threats from rival nations, there are a range of non-traditional threats which often have a greater impact on human security, such as infectious disease, climate change, food insecurity and competition over water resources. On the one hand, water scarcity and poor water quality can result in mass migration, increasing the likelihood of conflict through competition. On the other, sound freshwater management can help to ameliorate these risks, through cooperation in shared water bodies.

Conclusion

It is concluded that food security is a function of the availability of adequate food at the aggregate or household level and of peoples' access to that food. Moreover, this can be further categorized in terms of food security policy that has something to do with production and management of food availability, and in terms of national or human security affairs. Because of water obviously necessary for agriculture, it affects food security at the

macro level. Major findings include: First, despite agricultural production may increasingly satisfy domestic consumption demand, Pakistan is a net food importer. Second, nominal exchange rate needs to be adjusted when international food price fluctuates. Third, a good marketing system can have positive impact on the food security of a country. The results also highlight the importance of constructing reservoirs and priority on agriculture in macroeconomic framework. Amidst the changing tide of national security, increasing textbooks of security studies are now focusing on non-traditional security (NTS) rather than traditional security. Traditional environment threats such as armed conflict and war are being replaced by non-traditional security concerns including natural disaster and trans-boundary water. Also, such security is widened by food security (FS) and can go trans-spatial levels (Global, National, and local) to discuss the éstatist policies of security on the matter of addressed concern. A case study of Pakistan is also taken into account as Pakistan is in a riddle of water scarcity and food insecurity. Polynomial functions are exercise robust tools in order to analyze the relations in considered view of NTS including: Water security, food security, and environmental challenges like energy, planet and human behavior in an assumption of same independent conditions.

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