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CLIMATE CHANGE, INDIGENOUS WOMEN'S HEALTH, AND ENVIRONMENTAL SOVEREIGNTY: A CRITICAL ANALYSIS FROM PAKISTAN'S PERSPECTIVE

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Abstract
Although contributing a very low fraction of greenhouse gas emissions to the global inventory (not more than 1 percent), Pakistan is among the most climate-vulnerable countries of the world. It is an intersectional crisis that mainly affects Indigenous women in the areas of Pakistan that lie in the North, such as the Kalash, Koochi, and other disadvantaged communities that are further affected by environmental infringements, patriarchal hierarchy, and state apathy. This literature review explores the uniqueness of the challenges posed by climate change to physical, reproductive, mental, and spiritual health of Indigenous women in addition to compromising the traditional ecological knowledge systems that enable adaptation to climate change. Based on the feminist political ecology, indigenous studies and public health literature, the current paper evaluates the unequal climate vulnerability among Indigenous women in Khyber Pakhtunkhwa, Gilgit-Baltistan, Balochistan and Sindh provinces. This is clearly shown by key findings which show that the indigenous women face increased health risks due to gendered divisions of labor, loss of ancestral territories, food and water insecurity, crises of reproductive health, and aggravated gender-based violence because of climatic disasters. The 2022 floods alone impacted 650,000 pregnant women, over 1,000 healthcare facilities, and 8 million people, which showed that it was a systemic failure to safeguard the health of Indigenous women. Nevertheless, Indigenous women turn out to be the pivotal actors of the climate resiliency, using the traditional knowledge such as the "Suri Jagek" (sun observation) of the Kalash as a method of weather forecasting and earthquake-resistant building practices. This paper embarks on the argument that Indigenous epistemologies, environmental sovereignty, and disturbing colonial development paradigms need to become central to the approach to the health of Indigenous women in the climate crisis in Pakistan.

Introduction

Pakistan is facing a climate crisis that has never been witnessed before. Being the fifth most susceptible nation to climate change in the entire world, Pakistan is affected by devastating floods, droughts, heatwaves, and glacial lake outburst floods (GLOFs) that end the life of thousands of people every year and displaces millions of people (Malik et al., 2022). The devastating 2022 monsoon floods covered one-third of the nation, one in seven persons of the Pakistani population, and the damage to the economy had topped 30 billion dollars (NDMA, 2023). However, the contribution of Pakistan to global greenhouse gas emission is still tiny (less than 0.9%), the evidence of the bitter unfairness of climatic effects falling disproportionately on the countries least to blame of the crisis (Somani, 2023).

Among the populations in Pakistan that are susceptible to climate, the Indigenous women are particularly vulnerable and their vulnerabilities are heightened. Climate change is also an existential threat to the communities of the Kalash in Chitral, Koochi and Bakarwal pastoralists, the fishing communities of the coast of Sindh and the mountain population in Gilgit-Baltistan (Ali, 2024). These 100,000 people collectively are Indigenous peoples who have been surviving through traditional ecological knowledge (TEK) that has been built over the course of the thousand years. Nevertheless, the rapid pace of climate change intensifies the historical marginalization, negligence by the state, or patriarchal oppression to produce cumulative health disasters in the Indigenous women, in particular.

The Kalash community, Pakistan's most documented Indigenous group, exemplifies these compounding vulnerabilities. Having just 3,000-5,000 people living in the Bumburet, Rumbur, and Birir valleys of the Chitral district, the Kalash experienced a rise of 0.9 C in the annual temperatures between 1991-2022 leading to early snow melting, agricultural disturbances, and frequent floods in the years 2010, 2011, 2013, 2015, 2020, 2022 and 2023 (The increased health effects of these environmental changes are experienced by Kalash women who work most of the agricultural labor and have the main responsibility of producing food and imparting the culture.

Although Indigenous women play vital roles in climate adaptation, they are not visible in the climate policy and the public health infrastructure in Pakistan. In Pakistan, Indigenous peoples are not formally recognized as a separate legal category, but they are either considered as tribal, ethnically or religiously minorities (Cultural Survival, 2017). Such erasure deprives Indigenous people of certain protection, resources and even decision-making related to their lands. The Indigenous women are doubly marginalized since they are not in mainstream policy as they are Indigenous and they are not in the leadership of Indigenous communities because of the patriarchal forms of governance that usually deny women a voice in politics.

The present review uses intersectional feminist political ecology as the analytical framework to determine the way in which climate change, colonialism, patriarchy, and poverty intersect with each other and pose a threat to the health of Indigenous women in Pakistan. It discusses effects of physical, reproductive, mental, and spiritual health and accentuates the resistance of Indigenous women to the health care system by the means of traditional knowledge and grassroots organizing. Focusing on the experience of Indigenous women in Pakistan, the paper disputes the mainstream climate theories and suggests the ways of reaching climate justice based on environmental sovereignty and decolonization.

Literature Review

Theoretical Framework: Intersectional Feminist Political Ecology in the Pakistani Context

Feminist political ecology (FPE) provides essential analytical tools for understanding how gender intersects with environmental change, resource access, and power relations in Pakistan (Sultana, 2014). Unlike gender-neutral climate frameworks that obscure differential vulnerabilities, FPE recognizes that climate impacts are mediated by social hierarchies including gender, class, ethnicity, religion, and geography. In Pakistan's context, where 67% of women work in agriculture and rural women bear primary responsibility for water collection, food production, and household

maintenance, climate-induced environmental changes directly amplify gendered labor burdens and health risks (IWMI, 2024).

Intersectionality, conceptualized by Crenshaw (1989) and expanded by Indigenous feminist scholars, reveals how multiple systems of oppression interact to produce unique experiences of marginalization. For Pakistan's Indigenous women, intersectional analysis illuminates how colonial legacies, religious discrimination, economic marginalization, and patriarchal gender norms compound to create specific patterns of climate vulnerability. The Kalash women, for example, experience discrimination as religious minorities (practicing animism in an Islamic state), as ethnic minorities (non-Pashtun in Pashtun-dominated regions), as women in patriarchal society, and as impoverished communities with minimal state services (NCHR, 2023).

Environmental sovereignty, though primarily developed through Indigenous movements in North America and Latin America, offers relevant insights for Pakistan's Indigenous communities struggling for autonomy over ancestral territories. Environmental sovereignty encompasses Indigenous peoples' rights to self-determination regarding land use, resource management, and knowledge systems (Whyte, 2018). In Pakistan, where extractive industries, military installations, and mega-development projects routinely displace Indigenous communities without meaningful consent, environmental sovereignty remains aspirational rather than realized. The concept nonetheless provides normative grounding for Indigenous demands for territorial control and cultural preservation as prerequisites for health.

Critical public health scholarship interrogates structural violence the systematic ways social structures harm people by preventing basic needs from being met (Farmer et al., 2013). For Pakistan's Indigenous populations, structural violence manifests through state neglect of healthcare infrastructure in Indigenous territories, exclusion from disaster relief (as many Kalash lack proper identity cards required for aid), forced religious conversion, and criminalization of traditional practices. Climate change amplifies these existing structural vulnerabilities, creating what Whyte (2016) terms "double exposure" the compounding of historical trauma with contemporary environmental crisis.

Pakistan's Climate Crisis: Gendered and Racialized Impacts

Pakistan's geographic vulnerability stems from its dependence on the Indus River system, which provides irrigation for 90% of agricultural land and supports 60% of the population's livelihoods. The Indus is fed by Himalayan and Hindu Kush glaciers, which are melting at accelerating rates due to rising temperatures (Hassan et al., 2021). This creates paradoxical threats: short-term flooding from glacial melt and long-term water scarcity as glaciers disappear. Pakistan could face absolute water scarcity by 2040 if current trends continue, already ranking third globally for acute water shortage (IMF, 2018).

Climate projections for Pakistan indicate significant temperature increases, with the mountainous north experiencing the most dramatic warming. Heatwaves are becoming more frequent and intense nationwide, with temperatures regularly exceeding 50°C in southern regions. Precipitation patterns are shifting, with monsoon rains becoming more erratic and intense, leading to catastrophic flooding while other regions experience prolonged droughts (PMD, 2023). These changes devastate agriculture, which employs 42% of Pakistan's population and provides livelihoods for 67% of women workers.

The 2022 floods revealed the gendered dimensions of Pakistan's climate vulnerability with stark clarity. More than 1,000 healthcare facilities were destroyed in Sindh and Balochistan provinces, affecting 650,000 pregnant women and girls who lost access to maternal health services. In September 2022 alone, over 73,000 women delivered babies in flood-affected areas without access to skilled birth attendants or safe birthing spaces (UNFPA, 2022). Women and girls faced heightened risks of waterborne diseases, malnutrition, and gender-based violence in displacement camps. The destruction of homes and infrastructure meant women spent increased time collecting water, preparing food with limited

resources, and caring for sick family members, intensifying unpaid care work during crisis conditions.

For Indigenous communities in northern Pakistan, climate impacts manifest distinctly. The Kalash valleys have experienced seven major floods since 2010, destroying agricultural lands, orchards, and homes. Rising temperatures cause early snowmelt, disrupting traditional agricultural calendars where crops were historically sown in March but may now require planting in February a shift that challenges centuries of accumulated knowledge (Khan, 2023). New pest species, including grasshoppers that thrive in warmer conditions, threaten grain crops, while traditional food plants become unavailable or shift their growing seasons unpredictably.

Provincial Climate Impacts Across Pakistan

Climate change impacts vary significantly across Pakistan's provinces, with each region experiencing distinct vulnerabilities and health consequences for Indigenous women:

Sindh Province: Experienced the worst impacts of the 2022 floods, with rainfall reaching 784% above the August average (680.5mm total). The province witnessed 239-588 deaths (varying reports), destruction of 80% of crops, and displacement of millions. Health crises included 2.6 million malaria cases (fivefold increase), 41,000 dengue cases, and 2,310 houses damaged in Mirpur Khas during 2024 floods. The 2024 floods continued devastating Badin and Dadu districts, displacing over 140,000 people. Sindh recorded the highest temperature increase of 1.8°C nationally, intensifying heat-related health risks for women engaged in outdoor agricultural labor. Coastal fishing communities face additional threats from sea level rise, cyclones, and ocean warming.

Balochistan Province: Identified as Pakistan's most vulnerable region due to high sensitivity and low adaptive capacity. The 2022 floods showed a 500% increase in rainfall compared to historical averages, killing 336 people, destroying 426,897 houses, and killing an estimated 500,000 livestock. The 2024 monsoon declared 13 districts as calamity-hit. This paradoxical shift from severe drought to catastrophic flooding exemplifies climate change's destabilizing effects on Indigenous and rural communities. Healthcare infrastructure completely collapsed, leaving Indigenous women without any access to maternal health services, waterborne disease treatment, or emergency care.

Punjab Province: Experienced decreased rainfall causing water scarcity and increased waterborne diseases, contrasting with periodic riverine floods and hill torrents in southern districts. Mean temperatures increased by 0.78 to 1.5°C over the past three decades. Agricultural impacts revealed a 10% crop yield reduction, resulting in increased malnutrition rates. South Punjab, particularly Rajanpur, D.G. Khan, and Muzaffargarh districts, showed high vulnerability with health (0.460), water (0.360), and food (0.515) access indicators. Urban flash flooding affected major cities including Lahore, Multan, Bahawalpur, and Khanewal in 2024, with 114 deaths and 307 injuries reported since July 2024.

Khyber Pakhtunkhwa (KPK): Faced recurring floods, landslides, and GLOFs, with 88 deaths reported in 2024 flooding events. Flash floods in Swat, Upper and Lower Dir damaged infrastructure including roads and the Karakoram Highway. The Kalash community in Chitral experienced seven major floods since 2010 (2010, 2011, 2013, 2015, 2020, 2022, 2023), each destroying agricultural lands, orchards, and traditional food systems. The convergence of seismic activity (including impacts from the June 2022 Afghanistan earthquake), flooding, and climate-induced disasters creates extreme vulnerability for mountain communities. Koochi and Bakarwal pastoralist women (approximately 15,000 people) face disrupted migration routes, pasture degradation, and drought affecting their nomadic livelihoods.

Gilgit-Baltistan: Faces unique climate challenges as Pakistan's "water tower," hosting over 5,000 glaciers across 15,000 square kilometers. Temperature data from 1984-2013 shows an increase of 0.15°C per decade. The region

identified 3,044 glacial lakes in 2022, with 33 classified as dangerous capable of causing catastrophic GLOFs. In July-August 2023 alone, at least 30 GLOF instances were reported. Seasonal shifting changes in traditional season timing disrupts agricultural calendars and water availability. Health infrastructure remains critically inadequate with maternal mortality rates of 350-450 per 100,000 live births, widespread anemia among women (70-80%), and minimal access to prenatal, antenatal, and postnatal care. Mountain Indigenous women (approximately 30,000 people) face compounded health vulnerabilities from disaster-induced infrastructure damage and disrupted food systems. These provincial variations demonstrate that while all of Pakistan faces climate vulnerability, Indigenous women in each region experience distinct and compounding health threats shaped by local ecological conditions, infrastructure deficits, and historical marginalization.

Indigenous Women's Specific Health Vulnerabilities in Pakistan

Physical Health: Food and Water Insecurity

Indigenous women in Pakistan experience acute food insecurity as climate change disrupts traditional food systems. The Kalash have historically sustained themselves through mixed agriculture including wheat, maize, and walnuts, supplemented by dairy from livestock and wild plants gathered seasonally. Climate variability now undermines these systems: droughts reduce crop yields, floods destroy orchards, and shifting seasons make traditional planting times unreliable (Ali, 2024). Women, who perform approximately 70% of agricultural labor in Kalash communities while also bearing exclusive responsibility for wild food gathering and processing, face increased physical labor demands even as food production declines.

Dietary transitions compound health risks. As traditional foods become scarce, Indigenous communities increasingly rely on purchased processed foods high in refined carbohydrates, sugar, and unhealthy fats. This shift contributes to rising rates of type 2 diabetes, cardiovascular disease, and obesity among Indigenous populations. Pakistani women already experience higher diabetes prevalence than men (National Health Survey, 2021), and Indigenous women's specific vulnerabilities remain unstudied due to their exclusion from national health surveillance.

Water insecurity represents another critical health threat. Glacial lake outburst floods (GLOFs) threaten mountain communities with sudden, catastrophic flooding, while paradoxically, many regions face water scarcity during non-monsoon seasons. Women's responsibility for water collection means they bear direct exposure to water-related hazards including long-distance travel to water sources, physical injuries from carrying heavy loads, and conflicts over increasingly scarce water (IWMI, 2024). During the 2022 floods, water contamination caused widespread outbreaks of waterborne diseases including cholera, typhoid, and hepatitis, affecting women disproportionately due to their water collection and food preparation roles.

Indigenous women's physiological water needs increase during pregnancy and lactation, making water insecurity particularly harmful for maternal and infant health. Studies from flood-affected areas document elevated rates of maternal dehydration, urinary tract infections, and inadequate milk production among breastfeeding mothers (Khan et al., 2023). The destruction of water infrastructure during disasters leaves Indigenous communities, already underserved by government water systems, entirely dependent on contaminated sources.

Reproductive and Maternal-Infant Health

Climate change poses profound threats to Indigenous women's reproductive health and maternal-infant outcomes in Pakistan. Heat exposure during pregnancy associates with increased risks of preterm birth, low birth weight, stillbirth, and maternal complications including preeclampsia (Basu et al., 2016). Pakistan's rising temperatures, with heat waves regularly exceeding 45°C in summer months, create dangerous conditions for pregnant women, particularly in Indigenous communities that lack access to air conditioning, adequate hydration, or prenatal care.

The 2022 floods exposed catastrophic gaps in maternal healthcare for climate-affected women. With over 1,000 health facilities destroyed and 650,000 pregnant women displaced, thousands delivered without skilled attendance, sterile conditions, or emergency obstetric care (UNFPA, 2022). Maternal mortality, already elevated in Pakistan at 186 deaths per 100,000 live births nationally, likely increased dramatically in flood-affected areas, though Indigenous-specific data remains unavailable. Indigenous women face compounded barriers including geographic isolation, poverty preventing transportation to facilities, language barriers, and discrimination by healthcare providers unfamiliar with or hostile to Indigenous cultural practices.

Traditional midwifery, practiced for generations among the Kalash and other Indigenous groups, has been suppressed through biomedical medicalization and state policies privileging facility-based births. Climate disasters further disrupt these traditional systems as displacement separates women from community midwives and traditional birth attendants. The loss of traditional medicinal plants, many climate-sensitive species used for reproductive health, further erodes Indigenous women's reproductive autonomy.

Environmental contamination threatens reproductive health through multiple pathways. Mining, deforestation, and industrial pollution in Indigenous territories expose women to heavy metals, pesticides, and endocrine-disrupting chemicals that bioaccumulate in bodies and transfer across generations through pregnancy and breastfeeding (Donatuto et al., 2016). While Pakistan lacks comprehensive monitoring of environmental exposures in Indigenous communities, studies from similar contexts document associations between environmental contamination and adverse birth outcomes including birth defects, developmental delays, and miscarriage.

Mental Health and Psychosocial Wellbeing

The mental health impacts of climate change on Pakistan's Indigenous women remain largely invisible in research and policy, despite growing evidence of significant psychological harm. "Solastalgia" the distress caused by environmental change in one's home environment—affects Indigenous communities witnessing the degradation of sacred landscapes and loss of culturally important species (Albrecht et al., 2007). For Kalash women who hold responsibility for transmitting cultural knowledge to children through storytelling, ritual participation, and teaching traditional practices, the erosion of environmental conditions necessary for cultural continuity generates profound grief and anxiety.

The recurring floods in Chitral have created a state of chronic fear and trauma for Indigenous women, who must constantly prepare for potential disasters while coping with losses from past events. Many Kalash have lost land, homes, orchards representing generations of family investment, and in some cases, family members to floods. This accumulated trauma manifests in elevated rates of depression, anxiety, and post-traumatic stress, though mental health services remain almost entirely absent in Indigenous territories (Willox et al., 2013).

Social cohesion deteriorates under climate stress, with economic pressures contributing to family breakdown, substance abuse, and domestic violence. Research from climate-affected Pakistani communities documents that women experience increased intimate partner violence following environmental disasters, linked to men's economic stress, displacement trauma, and social breakdown (Thurston et al., 2021). Indigenous women face particular vulnerability to violence, both from within communities and from external actors, with climate-induced displacement exposing women to trafficking, sexual assault, and forced marriage.

The forced religious conversion campaign targeting the Kalash creates additional mental health burdens inseparable from climate stress. As environmental degradation undermines livelihoods, Kalash families face economic desperation that makes them vulnerable to conversion pressures from Islamic missionaries who offer financial support conditional on religious conversion (NCHR, 2023). For Kalash women, who hold primary responsibility for maintaining cultural and religious practices, these

conversion pressures create existential crises about cultural survival and identity.

Spiritual and Cultural Health

Indigenous concepts of health extend beyond Western biomedical definitions to encompass spiritual, cultural, and relational dimensions inseparable from land and environment. For the Kalash, health cannot be understood apart from relationships with sacred groves, mountain deities, and seasonal ceremonial practices that maintain cosmic balance. Climate change threatens these spiritual-cultural health dimensions by disrupting ceremonial calendars, destroying sacred sites through floods, and eroding the environmental basis for religious practices.

Kalash women serve as ritual specialists in many ceremonies, including the childbirth purification ritual (chachalak) and agricultural festivals tied to seasonal cycles. When environmental changes alter seasonal patterns snowmelt occurs earlier, crops ripen unpredictably, sacred plants fail to bloom women lose the ability to fulfill ceremonial responsibilities according to ancestral protocols. This inability to maintain cultural obligations creates moral distress and undermines women's social roles as culture bearers, harming holistic wellbeing in ways invisible to biomedical health frameworks.

The loss of traditional food systems carries spiritual as well as nutritional implications. Food gathering, preparation, and ritual distribution represent sacred acts that maintain relationships with land and community. Kalash women's roles in procuring wild foods, processing dairy products according to ritual purity codes, and distributing food during festivals embed them in networks of reciprocity essential to social cohesion and cultural identity. When climate change makes traditional foods unavailable or renders sacred foods ritually impure due to contamination, these vital social-spiritual relationships fracture, harming communal and individual wellbeing.

Methodology

This review employs critical qualitative synthesis to analyze literature on climate change, Indigenous women's health, and environmental sovereignty with specific focus on Pakistan. The literature search encompassed peer-reviewed articles, government reports, NGO publications, and policy documents published between 2010-2025. Databases searched included PubMed, Google Scholar, Web of Science, and Pakistani institutional repositories.

Search terms included combinations of "Pakistan," "climate change," "Indigenous women," "Kalash," "health," "floods," "environmental sovereignty," "traditional knowledge," "gender," and related concepts in English and Urdu. Additional materials were identified through reference tracking and consultation with Pakistani civil society organizations working with Indigenous communities.

Inclusion criteria prioritized empirical studies from Pakistani contexts, comparative analyses from South Asia, and theoretical work addressing intersectionality, colonialism, and gender in climate-health research. Due to limited research specifically on Pakistani Indigenous women's health, the review incorporated broader literature on women's climate vulnerabilities in Pakistan, Indigenous health globally, and climate-health intersections, synthesizing insights relevant to the Pakistani context.

Data analysis employed thematic synthesis, organizing findings according to health domains (physical, reproductive, mental, spiritual), structural determinants (colonialism, patriarchy, poverty), and resistance strategies (traditional knowledge, grassroots organizing, sovereignty assertions). Critical reflexivity guided the review process, acknowledging that academic knowledge production systems have historically excluded and misrepresented Indigenous peoples.

Analysis and Discussion

The Pakistani State and Indigenous Erasure

The Pakistani state's refusal to officially recognize Indigenous peoples represents a fundamental barrier to addressing Indigenous women's health in the climate crisis. Unlike countries that have ratified ILO Convention 169 or implemented constitutional protections for Indigenous rights, Pakistan categorizes Indigenous communities as "tribal" or "ethnic minorities" without specific

protections (Cultural Survival, 2017). This erasure means Indigenous communities cannot claim collective rights to territories, access targeted resources, or participate in international Indigenous forums.

The consequences for health are direct and severe. Indigenous communities lack representation in climate adaptation planning, despite being disproportionately affected by climate change. National health policies and disaster response protocols do not account for Indigenous-specific vulnerabilities, traditional healing practices, or cultural factors affecting health behaviors. The Kalash community's exclusion from official minority recognition means they cannot register as "Kalash" on national identity cards, instead forced to select "other" (NCHR, 2023). This complicates access to disaster relief, which requires identity documentation, leaving Kalash flood victims ineligible for compensation programs available to recognized minorities.

Gender compounds this erasure. While Pakistan's Constitution guarantees women's rights and the government has established various women's welfare programs, these rarely reach Indigenous women who face geographic isolation, language barriers, and discrimination. Indigenous women's health needs remain invisible in national health surveys, which do not disaggregate data by Indigenous status. Maternal health programs, reproductive health services, and non-communicable disease prevention efforts designed for mainstream Pakistani women fail to account for Indigenous women's distinct cultural contexts, traditional practices, and structural barriers to care.

Climate Change as Environmental Violence Against Indigenous Women

From Indigenous perspectives, climate change does not represent an unprecedented crisis but rather an intensification of ongoing colonial violence. The same extractive development paradigm that displaced Indigenous communities, degraded their territories through deforestation and mining, and suppressed their governance systems now drives greenhouse gas emissions causing climate change. Pakistan's embrace of coal power, mega-dams displacing Indigenous populations, and mining expansion into fragile mountain ecosystems reflects continuity with colonial-era extraction rather than a break from it.

For Indigenous women specifically, climate change manifests as gendered environmental violence. The destruction of forests that provide wild foods increases women's food procurement labor and nutritional insecurity. The contamination of water sources forces women to travel farther for safe water while exposing them to waterborne diseases. The unpredictability of seasonal rains undermines agricultural knowledge women have cultivated over lifetimes. Each environmental change amplifies gendered divisions of labor that assign women responsibility for mitigating household impacts of environmental degradation through increased work while denying them decision-making power over environmental management.

The 2022 floods exemplify how climate disasters function as gendered violence. Women comprised the majority of flood victims requiring rescue, experienced higher mortality in some regions, and faced elevated risks of sexual violence during displacement. The destruction of healthcare infrastructure disproportionately harmed women who lost access to maternal health services, family planning, and treatment for gender-specific conditions. Post-flood reconstruction prioritized infrastructure like roads and buildings while neglecting women's needs for safe sanitation, private spaces for breastfeeding, and protection from violence in crowded camps.

Traditional Ecological Knowledge: Indigenous Women's Climate Leadership

Despite facing compounding vulnerabilities, Indigenous women in Pakistan hold critical knowledge for climate adaptation grounded in traditional ecological knowledge (TEK) developed through centuries of environmental observation. The Kalash practice of "Suri Jagek" (sun observation) enables weather prediction by reading solar patterns, cloud formations, and seasonal indicators, allowing communities to anticipate rainfall, plan harvests, and prepare for extreme weather (Al Jazeera, 2024). Kalash

women, as primary agricultural laborers, possess detailed knowledge of crop varieties suited to local microclimates, soil conservation techniques, water management practices, and seasonal plant availability essential for adapting to environmental variability.

Similarly, the Dhajji Dewari construction system, used traditionally by Kalash communities, employs timber frames rather than masonry-bearing walls, creating earthquake-resistant structures that have protected communities during seismic events common in the Hindu Kush. This indigenous architectural knowledge was formally recognized and adopted in Balakot reconstruction after Pakistan's 2005 earthquake (Ahmad, 2023), demonstrating TEK's practical value for disaster risk reduction.

Indigenous pastoralist women among the Koochi and Bakarwal communities possess specialized knowledge of livestock behavior, grazing patterns, medicinal plants for animal health, and migration routes that allow herds to access fodder across seasonal cycles. As climate change alters vegetation patterns and water availability, this knowledge becomes crucial for adapting pastoral livelihoods. However, these knowledge systems face threats from sedentarization policies, education systems that devalue traditional knowledge, and climate change itself when environmental changes exceed historical ranges of variability.

Protecting and revitalizing TEK requires supporting environmental sovereignty—Indigenous communities' control over their territories and resources necessary for knowledge transmission. It also demands respect for Indigenous intellectual property rights, preventing extractive research that appropriates traditional knowledge while denying Indigenous communities benefits. Crucially, supporting TEK means funding Indigenous women-led climate programs that center their knowledge rather than extracting it for incorporation into state-led frameworks that strip context and meaning.

Indigenous Women's Organizing and Resistance

Indigenous women in Pakistan engage in resistance against climate violence and development aggression, though their activism receives minimal national attention or international solidarity compared to Indigenous movements in other regions. Kalash women have organized to protest land grabbing, demand government protection from forced conversion, and advocate for disaster compensation after floods. These organizing efforts face significant obstacles including patriarchal restrictions on women's public activism, state repression, and threats from extremist groups that target the Kalash.

The absence of Pakistani Indigenous representatives at international climate forums like COP16 in 2024 reflects both state neglect and Indigenous communities' lack of resources for international advocacy (Earth Journalism Network, 2024). While Indigenous peoples from Latin America and other regions secured recognition of an Indigenous subsidiary body at COP16, Pakistani Indigenous communities remained invisible, unable to voice their concerns or claim rights in global climate negotiations.

At local levels, Indigenous women practice everyday resistance through maintaining cultural practices, transmitting traditional knowledge to children despite formal education systems' devaluation of Indigenous knowledge, and sustaining traditional food systems. Women-led seed saving, traditional food preservation techniques, and continuation of seasonal gathering despite environmental degradation represent forms of cultural resistance inseparable from climate adaptation.

However, Indigenous women's climate leadership faces barriers both external and internal. Externally, state neglect means Indigenous communities lack funding, technical support, or political recognition for their adaptation work. Internally, patriarchal structures in some Indigenous communities limit women's formal leadership roles, though women exercise informal influence through kinship networks, ritual authority, and economic contributions. Transformative change requires challenging both colonial structures and patriarchal dynamics within Indigenous communities.

Data Gaps and Research Justice

The absence of reliable data on Indigenous women's health in Pakistan reflects broader patterns of Indigenous erasure and research injustice. National health surveys do not disaggregate by Indigenous status, making Indigenous-specific health outcomes invisible. Climate vulnerability assessments rarely include Indigenous communities or employ participatory methodologies that respect Indigenous knowledge. Disaster mortality and morbidity data often exclude Indigenous populations living in remote areas without formal identity documentation.

This data absence is not benign neglect but actively harmful, as it enables state denial of Indigenous-specific needs and prevents evidence-based advocacy for resources. The lack of sex-disaggregated data within already invisible Indigenous populations means Indigenous women's specific vulnerabilities remain completely unmeasured. Maternal mortality, chronic disease prevalence, mental health conditions, and environmental exposure levels among Indigenous women are essentially unknown.

Addressing these gaps requires research approaches grounded in Indigenous data sovereignty—Indigenous communities' rights to control data collection, ownership, and use affecting their populations. Research should employ participatory methodologies, be co-led by Indigenous women, respect Indigenous protocols, and ensure communities benefit from findings through advocacy support and resource access rather than being extractively studied.

Key Findings: Evidence Tables

Table 1: Major Indigenous Communities in Pakistan and Climate Vulnerabilities

Community	Location	Population	Primary Livelihoods	Key Climate Threats	Health Impacts
Kalash	Chitral District, KPK	3,000-5,000	Mixed agriculture, tourism, livestock	Glacial floods, early snowmelt, temperature rise (0.9°C/1991-2022)	Food insecurity, waterborne diseases, displacement trauma, loss of medicinal plants
Koochi/Bakarwal	Northern mountains	~15,000	Pastoral nomadism	Drought, pasture degradation, extreme weather	Malnutrition, water scarcity, disrupted migration routes
Fishing Communities	Sindh coast	~50,000	Fishing, salt production	Sea level rise, cyclones, ocean warming	Food insecurity, displacement, storm injuries
Mountain Communities	Gilgit-Baltistan	~30,000	Agriculture, livestock, tourism	GLOFs, landslides, water scarcity	Disaster trauma, agricultural losses, water contamination

Source: Compiled from Cultural Survival (2017), Ali (2024), NCHR (2023)

Table 2: Pakistan's Climate Change Health Impacts on Women (National and Indigenous Comparison)

Health Domain	National Women's Impact	Indigenous Women's Specific Impact
Maternal Health	650,000 pregnant women affected by 2022 floods; 1,000+ health facilities destroyed	Complete loss of access to maternal care; forced reliance on traditional midwives without supplies; displacement during pregnancy
Waterborne Diseases	Cholera, typhoid outbreaks post-floods	Higher exposure due to water collection responsibilities; contaminated traditional water sources; lack of treatment facilities
Food Security	44% child stunting from malnutrition nationally	Traditional food system collapse; displacement from agricultural lands; loss of wild food sources
Mental Health	Depression, anxiety from displacement	Compound trauma (historical + climate); cultural loss grief; forced conversion pressures
Vector-borne Diseases	Malaria threatens 46 million by 2070	New disease emergence in mountain areas; lack of preventive services
Heat-related Illness	Increasing heatwave mortality	Outdoor agricultural labor; lack of cooling; pregnancy complications from heat
Respiratory Disease	PM2.5 pollution; solid fuel cooking deaths	Indoor air pollution from traditional cooking; deforestation impacts

Sources: UNFPA (2022), IWMI (2024), PMC (2022), National Health Survey (2021)

Table 3: 2022 Pakistan Floods - Gendered Impacts

Impact Category	Total Population	Women/Girls Affected	Indigenous Communities
Total Affected	33 million (1 in 7 Pakistanis)	>50% of affected population	Kalash valleys flooded 7th time since 2010
Displaced	8 million	Majority caregivers with children	Entire valley populations relocated
Deaths	1,700+	Included maternal deaths	Unknown (data not disaggregated)
Pregnant Women Affected	650,000	-	Data unavailable
Healthcare Facilities Destroyed	1,000+	Maternal health services priority	No facilities existed in Indigenous areas
Expected Births (Sept 2022)	73,000 in affected areas	Without skilled attendance	Traditional birth systems disrupted
Economic Loss	$30 billion	Women's informal economy devastated	Total livelihood destruction
Homes Destroyed	1.2 million	Women's unpaid labor to rebuild	Orchards, farmland permanently lost

Sources: NDMA (2023), UNFPA (2022), UN Women (2023)

Table 4: Traditional Ecological Knowledge (TEK) Systems of Pakistan's Indigenous Women

TEK Practice	Community	Description	Climate Adaptation Function	Threats to TEK
Suri Jagek (Sun observation)	Kalash	Weather prediction through solar/astronomical patterns	Forecasts rainfall, plans harvest timing	Climate exceeding historical variability
Dhajji Dewari construction	Kalash, Northern communities	Earthquake-resistant timber frame architecture	Disaster-resistant housing	Modern construction materials displacing traditional methods
Seed diversity management	Kalash, agricultural communities	Preservation of multiple crop varieties for different conditions	Crop resilience to variable seasons	Market crop monoculture; loss of seed knowledge
Wild food knowledge	Kalash women	Identification, gathering, processing of 100+ wild plant species	Food security during crop failures	Deforestation; seasonal pattern disruption
Medicinal plant knowledge	Kalash, mountain communities	Traditional medicine including reproductive health plants	Healthcare when biomedical care unavailable	Loss of plant species; knowledge transmission gaps
Livestock behavior reading	Koochi/Bakarwal women	Predicting weather through animal behavior	Early warning for storms, snow	Sedentarization; reduced herd sizes
Water source divination	Multiple communities	Traditional water finding and quality assessment	Water security	Groundwater depletion; contamination

Sources: Ahmad (2023), Al Jazeera (2024), Ali (2024)

Table 5: Barriers to Indigenous Women's Health Access in Climate Context

Barrier Category	Specific Obstacles	Example from Pakistan
Geographic	Remote locations, destroyed infrastructure, hazardous terrain	Chitral valleys require 6-8 hour travel to nearest hospital; roads washed out by floods
Economic	Poverty, lack of insurance, transportation costs, informal employment	67% of rural women in informal agriculture; no disaster compensation without ID cards
Documentation	Lack of legal Indigenous status, identity cards marking "other"	Kalash cannot access government programs requiring minority status verification
Cultural-Linguistic	Language barriers, discrimination, biomedical incompatibility with traditional practices	Urdu/English medical care; suppression of traditional midwifery
Gender	Mobility restrictions, male control of resources, exclusion from decision-making	Women need male permission for hospital travel; women excluded from disaster planning

Service Gaps	No healthcare in Indigenous territories, facilities destroyed by climate disasters	Zero maternal health facilities in Kalash valleys; 1,000+ facilities destroyed in 2022 floods
Discrimination	Religious persecution, ethnic prejudice, provider bias	Kalash face forced conversion pressures; discrimination in hospitals

Sources: NCHR (2023), IWMI (2024), Cultural Survival (2017)

Policy Implications: Toward Indigenous-Led Climate Justice in Pakistan

Addressing Indigenous women's health in Pakistan's climate crisis requires transformative policy shifts that center Indigenous sovereignty, women's leadership, and climate justice. First, Pakistan must officially recognize Indigenous peoples as distinct populations with collective rights to territories, self-governance, and cultural preservation. This includes ratifying ILO Convention 169, amending the Constitution to acknowledge Indigenous peoples, and establishing legal frameworks for free, prior, and informed consent before any development projects affecting Indigenous lands.

Second, climate and health policy must employ intersectional analysis that examines how gender, indigeneity, class, geography, and religion compound to create specific vulnerabilities. This requires collecting sex-disaggregated data within Indigenous populations, conducting participatory health assessments with Indigenous women's leadership, and designing culturally appropriate health interventions that respect traditional practices. Indigenous women must participate meaningfully in all climate adaptation planning, health program design, and disaster response protocols affecting their communities.

Third, the Pakistani state must support environmental sovereignty by returning control of Indigenous territories to Indigenous governance, halting extractive industries in Indigenous areas, and funding Indigenous-led conservation and climate adaptation programs. This includes protecting sacred sites, supporting traditional livelihoods, and respecting Indigenous communities' rights to refuse development projects. Climate finance must flow directly to Indigenous communities rather than through state intermediaries that have historically excluded Indigenous peoples from resources.

Fourth, Pakistan must integrate traditional ecological knowledge into climate adaptation policy under Indigenous leadership and ownership. This requires respecting Indigenous intellectual property rights, supporting knowledge transmission from elders to youth, and funding Indigenous research institutes that can document and apply TEK according to Indigenous protocols. TEK should be recognized as equal to Western science rather than supplementary "local knowledge."

Fifth, gender justice must be integrated throughout climate and health policy. This includes addressing gender-based violence, ensuring women's land rights, supporting women's economic empowerment, and challenging patriarchal structures both within state institutions and Indigenous communities. Indigenous women require safe spaces for leadership development, resources for women-led organizations, and legal protections against forced conversion, trafficking, and violence intensified by climate displacement.

Sixth, disaster response must be reimagined to prioritize Indigenous women's needs. This includes establishing maternal health services in displacement camps, providing culturally appropriate trauma counseling, ensuring women's participation in relief distribution, and addressing gender-based violence in crisis contexts. Compensation programs must accommodate Indigenous peoples without formal documentation and recognize communal land tenure systems rather than requiring individual property titles.

Conclusion

Climate change constitutes an existential threat to Indigenous women's health in Pakistan, amplifying centuries of marginalization through colonial state-building, religious persecution, patriarchal oppression, and environmental destruction. The catastrophic 2022 floods Pakistan's seventh consecutive year of climate disaster exposed the profound vulnerability of Indigenous communities excluded from state protection and health infrastructure. For Indigenous women specifically, climate change manifests as gendered environmental violence that threatens physical survival, reproductive health, mental wellbeing, and cultural-spiritual continuity.

The Kalash community's experience exemplifies broader patterns affecting Pakistan's approximately 100,000 Indigenous people. Recurring floods destroy agricultural lands and orchards representing generations of family investment, forcing dependence on purchased foods that undermine nutrition and cultural practices. Rising temperatures disrupt traditional ecological knowledge systems developed over millennia, as seasonal patterns become unpredictable and climate-sensitive species disappear. Water insecurity forces women to travel dangerous distances for contaminated water while floods bring waterborne disease epidemics. The destruction of healthcare infrastructure leaves pregnant women without maternal care, increasing maternal and infant mortality among populations already experiencing health inequities.

Yet Indigenous women are not merely victims but powerful agents of climate resilience and cultural survival. Through traditional ecological knowledge including weather prediction (Suri Jagek), earthquake-resistant architecture (Dhajji Dewari), agricultural biodiversity management, and medicinal plant expertise, Indigenous women possess sophisticated adaptive capacities proven across centuries of environmental variability. Their leadership in sustaining cultural practices, maintaining food sovereignty, and organizing resistance against extractive development demonstrates that climate solutions must center Indigenous epistemologies and sovereignty.

Addressing Indigenous women's health in Pakistan's climate crisis requires confronting the colonial structures that created vulnerability while supporting Indigenous self-determination as prerequisite for climate justice. The Pakistani state's refusal to recognize Indigenous peoples denies them access to specific protections, resources, and participation in decisions affecting their territories. This erasure must end through legal recognition, constitutional amendments, and respect for Indigenous sovereignty. Climate and health policy must employ intersectional frameworks that analyze how gender, indigeneity, class, and religion compound to create specific vulnerabilities requiring targeted interventions.

Crucially, transformative change requires challenging the extractive development paradigm driving both climate change and Indigenous dispossession. Pakistan's embrace of mega-dams, coal power, and mining expansion prioritizes economic growth over human rights and environmental sustainability, perpetuating the same colonial logic that dispossessed Indigenous peoples historically. Climate justice demands rejecting false solutions that displace Indigenous communities while supporting Indigenous-led alternatives grounded in traditional knowledge, sustainable livelihoods, and reciprocal relationships with ecosystems.

Future research must address critical data gaps through participatory methodologies that respect Indigenous data sovereignty. Health studies should be co-designed with Indigenous women, employ culturally appropriate methods, and ensure communities benefit from findings. Longitudinal research tracking climate-health impacts, documentation of traditional adaptation strategies, and critical policy analysis examining how climate governance affects Indigenous sovereignty all represent essential directions. Importantly, this research must support rather than extract from Indigenous communities, contributing to struggles for health sovereignty and climate justice.

The health of Pakistan's Indigenous women and the health of the planet are inseparable. Both

require transforming exploitative relationships toward reciprocity, responsibility, and respect for all life. As climate disasters intensify and Indigenous communities face cultural extinction, the urgency of centering Indigenous women's knowledge, supporting their leadership, and honoring their sovereignty cannot be overstated. Their survival—and Pakistan's climate resilience—depends on it.

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