

Traditional Ecological Knowledge as Health Sovereignty: Ethnomedical Systems, Resilience and Justice in Indigenous Communities

C.J. Sonowal

Tata Institute of Social Sciences, Mumbai 400 088, India

ORCiDs: <https://orcid.org/0000-0002-8717-1480>

E-mail: <chunuda@yahoo.com>, <moina@tiss.edu>, <moina@tiss.ac.in>

KEYWORDS Kincentric Ontology. Biocultural Rupture. Cultural Suppression. Epistemic Violence. Decolonial Pathways. Ecoliteracy

ABSTRACT This review paper examines the biocultural relationship between ecological integrity and Indigenous health, emphasising that ecological justice is integral to health justice. Synthesising global and Indian scholarship from 2000 to 2024 through decolonial frameworks, the study highlights how kincentric ontologies position health as relational harmony sustained by reciprocal ties to land and ancestral knowledge systems. Land dispossession, cultural suppression, and epistemic violence led to intergenerational health trauma, nutritional deprivation, and epidemics of non-communicable and mental health crises. In India, deforestation, industrialisation, and restrictive policies have eroded Traditional Ecological Knowledge (TEK), exacerbating malnutrition and gendered epistemic injustice. It identifies TEK as vital for Indigenous health sovereignty, enabling preventive care, environmental monitoring, and culturally grounded resilience. It calls for land repatriation, biocultural conservation, healthcare models integrating TEK with biomedicine, and policy reforms centering Indigenous data sovereignty and gender justice. The findings underscore that healing Indigenous health requires restoring ecological and cultural relationships.

INTRODUCTION

The complex interdependence between ecological systems and human health represents one of the most profound yet underappreciated dimensions of global well-being. For Indigenous peoples worldwide, this relationship transcends conventional environmental determinism, and it embodies a bioconstitutive nexus in which health emerges from reciprocal, kincentric relationships with land, water, plants, animals, and ancestral spirits (Salmon 2000; Robin et al. 2022). Instead of putting humans as the dominators of nature, this worldview positions humans as kin within a living web of mutual obligation (Salmon 2000). This perspective of health and ecology justifies the relationship as the harmonious flow of shared breath through this network, sustained by practices of respect, reciprocity, and stewardship (Tyagi 2024). The operational mechanism in this relationship is the TEK, which integrates physical,

mental, emotional, social and spiritual well-being into a holistic system, which Garnett et al. (2009) refer to as “Healthy Country is Healthy People”.

There is ample evidence that reveals how and to what extent the colonialism systematically destroyed this biocultural nexus, through land dispossession, suppression of cultural practices, and distorting and denying the epistemic foundations of Tribal Traditional Knowledge (TTK), leading to intergenerational health traumas that manifest as contemporary health disparities (King and Smith 2000; Redvers and Blondin 2020). The forcible displacement of indigenous people from ancestral territories, destruction of medicinal and nutritional ecosystems, and criminalisation of traditional ceremonies (for example, Potlatch bans, nature worship, and extraction of forest produce) ruptured the material and spiritual foundations of Indigenous health (Panghal et al. 2010; Halder 2018). Consequently, communities face epidemics of diabetes, cardiovascular disease, and mental health crises, as the direct outcomes of disrupted food systems, loss of TEK, and cultural dislocation (Turner et al. 2022; Tyagi 2024). Studies substantiate the fact that the Western biomedical frameworks often perpetuate harm by

Address for correspondence:

Dr. C.J. Sonowal
103, Sai Shraddha, Plot 66, Sector 4A,
Kopar Khairane, Navi Mumbai 400 709

dismissing Indigenous ontologies of health and well-being, enabling biopiracy, and failing to address cumulative burdens of environmental toxins, historical trauma, and socioeconomic stress (Isaac et al. 2018; Chong et al. 2024).

In India, one encounters a similar situation, where this nexus is critically strained. Tribal health is rooted in ecocultural systems where forests provide more than 50 percent of nutritional and medicinal needs, sacred groves anchor spiritual well-being, and “ecoliteracy” governs sustainable resource use (Majumdar and Chatterjee 2021; Kala 2022). Nevertheless, deforestation, state-led industrialisation, and restrictive policies such as flawed Forest Rights Act implementation have triggered cascading crises, like malnutrition, a dual burden of infectious and non-communicable diseases (NCDs), and erosion of ethnomedical knowledge (Xavier 2018; Kanrar et al. 2023). Gendered epistemic injustice further marginalises women healers and disrupts intergenerational TEK transmission (Sabar and Midya 2022; Tirkey et al. 2024).

This review argues that “ecological justice is health justice”. Synthesising global and Indian scholarship, the researchers contend that decolonising health paradigms requires centering Indigenous sovereignty through land repatriation, biocultural conservation, and epistemologically reconciled healthcare. In this perspective, TEK, far from “primitive” lore, is the architecture of resilience, offering sentinel monitoring of environmental change, preventive care via sustainable stewardship, and culturally grounded healing (Jessen et al. 2022; Mohd Salim et al. 2023). It necessitates the deconstruction and reformulation of structural arrangements in policy, co-designing habitat-specific solutions with tribes, and affirming that people’s health is inextricable from the health of their ecology (Kumar and Sahoo 2019; Negi and Azeez 2022). As Langaniki Robin affirms, “*Ngamana Tjukurpa kuwarri kunpu kanyini*” or “We are now taking strong care of our culture” (Robin et al. 2022). This act of care is the ultimate prescription for planetary health.

This paper first elucidates the kincentric ontology underpinning Indigenous health systems, demonstrating how concepts like *iwigara* (the kinship of all living beings, particularly plants and people) and *Tjukurpa* (the Aboriginal creation stories, law, and moral guidelines, deeply intertwined with the land and its creatures) position

health as relational harmony sustained by reciprocal ties to land. The analysis then documents colonialism’s violent severance of this nexus through land dispossession, cultural suppression, and epistemic violence, triggering intergenerational health trauma manifested as nutritional deprivation, NCD epidemics, and mental health crises globally in general and in India in particular. TEK is positioned as the essential architecture for health sovereignty, enabling preventive care, sentinel environmental monitoring, and culturally grounded resilience despite intensifying threats from market pressures, knowledge erosion, and climate change. The paper incorporates a dedicated analysis of the Indian scenario, detailing how ecology functions as embodied health infrastructure through material sustenance, disease ecology, spiritual well-being, and ecoliteracy, while critiquing policy failures that exacerbate vulnerabilities like the particularly vulnerable tribal groups’ (PVTG) malnutrition and gendered epistemic injustice. Building on this, the discussion proposes concrete decolonial pathways, including land repatriation, biocultural conservation, epistemologically reconciled healthcare, and gender justice, arguing that healing people necessitates healing the country. The work concludes by prioritising community-led research to operationalise health sovereignty through quantified land-repatriation impacts, Indigenous-led risk assessment frameworks, and gendered TEK transmission studies, asserting that honouring the truth, “Healthy Country is Healthy People”, demands transformative solidarity.

Objectives

The objectives of the study are to:

1. Elucidate the kincentric ontology underpinning the ecology-indigenous health nexus, where health is co-constituted within reciprocal relationships with land.
2. Document the biocultural rupture inflicted by colonialism as the primary driver of health trauma.
3. Position TEK as the essential operational framework for Indigenous health sovereignty.
4. Identify contemporary pressures threatening this nexus.

5. Propose decolonial pathways towards restorative health justice through biocultural resurgence, incorporating a detailed analysis of the Indian scenario.

MATERIAL AND METHODS

Systematic Literature Review

To develop the paper, a systematic literature review (SLR) method was employed. It is a methodical and structured approach to reviewing existing research on a specific topic. It follows a rigorous, predefined protocol to ensure comprehensiveness in analysis, objectivity through evidence-based conclusions, and reproducibility. In fields like medicine, public health, and social sciences, SLRs guide clinical guidelines, policy decisions, and future research directions. An SLR is particularly valuable in Resolving Contradictions in Research, Establishing Evidence-based Practices, and Identifying Research Gaps. The SLR method is known for its capability of bias reduction, enhancing credibility, supporting meta-analysis, and promoting transparency and replicability. However, amidst these strengths, SLR has some limitations, because the process is time and resource-intensive, it has strict inclusion criteria for which there is a probability that some relevant studies may be excluded if they do not meet methodological standards. Further, it depends on existing literature, and in case of scarce high quality studies, the conclusion may be affected.

Research Design

This paper employs a **critical interpretive synthesis** methodology, integrating systematic review principles with decolonial theoretical frameworks. The approach prioritises indigenous epistemologies, contextualises power dynamics in knowledge production, and centres the voices of Indigenous scholars and communities. The synthesis aimed to:

- ♦ Map global patterns in the ecology-indigenous health nexus.
- ♦ Critically analyse colonial disruptions and contemporary threats.
- ♦ Identify pathways for restorative justice, with a focused lens on India.

Literature Search Strategy

A multi-phase search was conducted (January 2000 to April 2024) across:

- ♦ **Databases:** Scopus, Web of Science, PubMed, JSTOR, DOAJ, and region-specific repositories (for example, IndMed, African Journals Online).
- ♦ **Keywords:**
- ♦ **Core Concepts:** (“Indigenous health” OR “tribal health” OR “Adivasi arogya”) AND (“ecological health” OR “biocultural diversity” OR “Traditional Ecological Knowledge” OR “TEK”).
- ♦ **Contexts:** (“colonialism” OR “land dispossession”) AND (“health justice” OR “decolonisation”) AND (“India” OR “Global South”).
- ♦ **Grey Literature:** Policy documents (for example, Forest Rights Act evaluations), NGO reports, Indigenous-led publications identified via Google Scholar, institutional repositories, and partnerships with Indigenous research networks.
- ♦ **Snowballing:** Citation chaining of seminal works (for example, Salmon 2000; Garnett et al. 2009).

Table 1 shows the various categories under which the literature were classified and the criteria based on which the literature were selected or rejected for final review.

Inclusion/Exclusion Criteria

Data Extraction and Synthesis

Thematic Coding

Literature was coded in NVivo 14 using deductive codes aligned with research objectives (for example, “*kincentric ontology*”, “*biocultural rupture*”, “*TEK as healthcare*”) and inductive codes from emergent themes (for example, “*gendered epistemic injustice*”, “*market double-bind*”).

Critical Analysis Framework

- ♦ **Decolonial Lens:** Interrogated power structures in knowledge production (for example, privileging Western science over TEK).

Table 1: The inclusion and exclusion criteria of literature to be reviewed

Category	Inclusion criteria	Exclusion criteria
Population	Indigenous/tribal communities globally; Indian Adivasi groups (for example, PVTGs, Gonds).	Non-Indigenous populations; urban health studies without ecological focus.
Thematic focus	Ecology-health linkages, TEK, colonial impacts, biocultural resilience, health sovereignty.	Studies reducing health to biomedical metrics without a socio-ecological context.
Publication type	Peer-reviewed papers, books, dissertations, policy briefs, and Indigenous community reports.	Non-empirical commentaries; inaccessible texts.
Time Frame	2000-2024 (with historical context from foundational pre-2000 works).	Pre-2000 literature, unless seminal.

- ♦ Synergistic Burden Model: Analysed cumulative impacts (for example, environmental toxins + historical trauma) using Isaac et al. (2018) and Chong et al. (2024).
- ♦ Spatial Vulnerability Mapping: Highlighted regional disparities (for example, India's PVTGs versus urban-fringe tribes).

Integration

Global and Indian literatures were synthesised separately, then cross-compared to identify transnational patterns and context-specific barriers.

RESULTS

The relationship between ecology and Indigenous health transcends environmental influence represents a profound bioconstitutive nexus where human well-being emerges from and actively sustains the vitality of specific landscapes, knowledge systems, and relational ontologies. Drawing upon the compiled literature, this paper critically examines the multifaceted, dynamic, and often imperiled nature of this relationship, moving beyond correlation to explore its ontological foundations, the devastating impacts of rupture, and the pathways toward restorative justice and health sovereignty.

Foundational Ontology

At the heart of the ecology-health relationship lies a kincentric worldview, a fundamental ontological understanding that humans are not separate from, but kin to, all elements of the natural world, plants, animals, rivers, mountains, and

ancestral spirits. This is not a metaphor, but a lived reality, as one can see in the following descriptions.

Rarámuri Iwigara

Enrique Salmon (2000) elucidates the Rarámuri concept of *iwigara*, the shared breath/soul animating all life. Health (*ivi*) is the harmonious flow of this shared breath within the kin network. Harvesting medicine involves protocols of respect and reciprocity, ceremonies like the *tesgüinada* (corn beer festival) honour the corn ancestor *Onoruame*, ensuring rain (ecological vitality) and strengthening the “complex cycle of breath and life”. Failure to do so disrupts this flow, causing drought and collective illness. Practices like selective harvesting or transplanting wild onions (*sepé*) are acts of kin care, ensuring mutual flourishing and sustained health resources.

Australian Aboriginal Tjukurpa

Langaliki Robin (Robin et al. 2022) describes *Tjukurpa* (Dreaming Law) for the Pitjantjatjara people, an Aboriginal people of the Central Australian desert, as the living law governing relationships between people, ancestors, land, and all beings. The authors find that holding, carrying, and passing on sacred knowledge (*Tjukurpa*) gives Aboriginal people great strength, and it contributes to the well-being of the people. Connection to specific places, particularly water sources (*tjukula*), is mandated by *Tjukurpa* and intrinsically linked to health. Being in the country facilitates physical activity, provides nutritious bush foods, offers spiritual fulfillment, reinforces iden-

tity, and fosters intergenerational bonding, all core determinants of health. As Langaliki states, sharing these stories of place and kin makes people feel happy and strong.

Holism in Practice

Rashmi Tyagi (2024) emphasises that Indigenous Knowledge Systems (IKS) integrate physical, mental, emotional, social, and spiritual dimensions. Healing ceremonies (like, Sweat Lodge, *yúmarí* dances) simultaneously address imbalances within the individual and their relationships with community, ancestors, and the land. Sweat lodges are small, dome-shaped structures used for purification and healing rituals. Participants enter the lodge, which is heated with hot stones, and pray for themselves, their families, and the world. Considered a sacred space, the sweat lodge is seen as a womb of the Earth, where individuals can symbolically die and be reborn.

Yúmarí is a Huichol or Wixárika ceremony that involves prayer, music, and the ritual consumption of peyote. The Huichol are an Indigenous people primarily located in the Sierra Madre Occidental Mountain range of Mexico. The *yúmarí* ceremony is a way for the Huichol to connect with their deities and ancestors, and it is considered a powerful means of spiritual and physical healing. The use of peyote is central to the *yúmarí* ceremony, and it is viewed as a sacred plant that allows individuals to communicate with the spirit world. Traditional Chinese Medicine's balance of Yin/Yang and Qi reflects understandings of health as harmony within the individual and with the broader cosmic/natural order (Pan et al. 2014). In Chinese philosophy, *yin-yang* is conceived as the coherent fabric of nature and mind, exhibited in all existence, as *jiao* (interaction) between the waxing and waning of the cosmic and human realms, and as a process of harmonisation ensuring a constant, dynamic balance of all things. Similarly, the Indian traditional medicinal system, Ayurveda, focuses on Doshas. Health, therefore, is not an individual state achieved in isolation, but the flourishing of reciprocal relationships within a living kin network. Stewardship of a country is not merely conservation, but also preventative healthcare for the entire biotic community, humans included.

Biocultural Rupture and Health Trauma Under the Colonial Regime

Worldwide history and literature reveal that colonisation systematically attacked the biocultural nexus prevalent among the indigenous societies, inflicting wounds that manifest as contemporary health disparities.

Land Dispossession and Environmental Degradation

Direct Impact

Colonisation and neo-colonisation have a history of forcible removal of the indigenous people from their ancestral territories, employing deforestation, mining, and inflicting pollution. The large-scale agriculture destroyed the material foundation of health, including medicinal plants, traditional food sources, and clean water. Ladio and Lozada (2009) document how rural communities in Argentina's Monte region, reliant on wild plants for food and medicine, face vulnerability due to land degradation, desertification, and loss of access. Similarly, Derso et al. (2024) report that 75 percent of medicinal plants used by Ethiopian communities are wild-harvested, making them highly susceptible to habitat loss.

Nutritional Trauma

The disruption of traditional food systems, often replaced by processed foods, led directly to epidemics of diabetes, cardiovascular disease, and obesity. Garnett et al. (2009) found that homelands residents in Australia, actively engaged with country and traditional foods, had significantly lower rates of diabetes and chronic disease risk factors compared to those in centralised settlements. Turner et al. (2022) starkly link the loss of diverse, nutrient-rich traditional diets to widespread health decline among Indigenous peoples globally.

Suppression of Cultural Praxis and Knowledge Transmission

Targeted Destruction

Colonial administrations, as well as the national governments, have also undertaken cer-

tain measures in the name of civilising or developing the indigenous peoples worldwide. For instance, a potlatch is a gift-giving feast practiced by Indigenous peoples of the Pacific Northwest Coast of Canada and the United States. A potlatch involves giving away or destroying wealth or valuable items to demonstrate a leader's wealth and power. Potlatches often involve music, dancing, singing, storytelling, making speeches, joking, and games. The honouring of the supernatural and the recitation of oral histories are a central part of many potlatches.

From 1885 to 1951, the Government of Canada criminalised potlatches. Obviously, along with this ban, a lot of indigenous practices, having socio-cultural significance, lost their existence. Since the practice was decriminalised in 1951, the potlatch has re-emerged in some communities. In many, it is still the bedrock of Indigenous governance, as in the Haida Nation, which has rooted its democracy in potlatch law.

The Sun Dance is a significant religious ceremony practiced by various Indigenous peoples, particularly those of the Plains cultures in North America, focused on prayer, endurance, and seeking spiritual guidance. It is a communal event designed to reconnect with the earth, seek healing, and renew spiritual connections.

After European colonisation of the Americas, and with the formation of the Canadian and United States governments, both countries passed laws intended to suppress Indigenous cultures and force assimilation into Christianity and majority-Anglo-American culture. The Sun Dance was one of the prohibited ceremonies. Though it was decriminalised in Canada in 1951 and 1978, in the United States, by the time it lost its vigour and characters.

Indigenous children were forcibly removed from their families and communities by colonial powers and governments, often under the guise of cultural assimilation, aimed to strip Indigenous children of their languages, cultures, traditions, and spiritual beliefs, and replace them with those of the dominant society. For instance, the Canadian Indian residential school system forcibly removed Indigenous children from their families and placed them in boarding schools run by Christian churches, to assimilate them into Euro-Canadian culture by suppressing their own. Similar policies and practices occurred in other countries like the

United States, Australia and New Zealand, with devastating consequences for Indigenous communities. Redvers and Blondin (2020) detail how this suppression severed connections to healing traditions and undermined cultural identity, contributing to intergenerational trauma, a core determinant of mental health issues and substance abuse (Tyagi 2024).

Knowledge Erosion

Policies like the Indian ban on snake charming (Panghal et al. 2010) destroyed the context for specialised ecological knowledge (for example, Saperas' antivenin plant use). Modernisation, formal education displacing place-based learning, urbanisation, and youth disinterest further disrupt intergenerational transmission. Eshete and Molla (2021) found medicinal plant knowledge concentrated among older, illiterate Guji men in Ethiopia, with transmission hindered by secrecy norms and cultural shifts. Caballero-Serrano et al. (2019) documented an apparent generational decline in medicinal plant knowledge and cultivation in Ecuadorian Amazon home gardens, with women identified as crucial, yet potentially marginalised, knowledge transmitters.

Epistemic Violence and Biomedical Dominance

Dismissal and Exploitation

Traditional healing knowledge was pathologised as "primitive" or "superstitious". Western healthcare systems were imposed, often disrespecting cultural norms and spiritual dimensions of health (Redvers and Blondin 2020; Tyagi 2024). Redvers and Blondin (2020) recount an oncologist dismissing a healer as a "witch doctor", exemplifying pervasive disrespect. Furthermore, pharmaceutical biopiracy, extracting medicinal knowledge without consent or benefit-sharing, represents ongoing exploitation (Isaac et al. 2018).

Inadequate Frameworks

Conventional risk assessments, such as Human Health Risk Assessment/Ecological Risk Assessment (HHRA/ERA), fail catastrophically for Indigenous health. Chong et al. (2024) demonstrate that they ignore unique exposure path-

ways (for example, ceremonial smudging), disregard cumulative burdens (environmental toxins plus historical trauma plus socioeconomic stress), and lack cultural competence. Crucially, communities express deep mistrust in externally driven processes and results, rooted in historical exploitation (Sandlos and Keeling 2016). Colonialism inflicted ecological degradation and health crises because they are manifestations of the same fundamental rupture, that is, the violent severing of people from their kin, their knowledge, and their life-sustaining country.

TEK: The Architecture of Health Sovereignty

TEK is not merely “local knowledge” but the operational framework for Indigenous health sovereignty, self-determination in maintaining well-being, which can be understood with the help of the following evidence.

Holistic Healthcare System

TEK provides accessible, culturally congruent primary healthcare. Pamiri communities are an Eastern Iranian ethnic group primarily residing in the Pamir Mountains, specifically in Tajikistan (Gorno-Badakhshan), Afghanistan (Badakhshan), Pakistan (Gilgit-Baltistan and Chitral), and China (Taxkorgan Tajik Autonomous County). Mohd Salim et al. (2023) note that Pamir communities use 58 plants for 63 treatment categories, reducing dependence on costly biomedical systems. Tyagi (2024) reveals that IKS emphasises prevention and treating root causes (imbalance) rather than just symptoms. The author finds that the midwifery services grounded in cultural values (for example, Māori in New Zealand) lead to higher satisfaction and better maternal/neonatal outcomes compared to the modern bio-medical regimen.

Preventive Care and Resilience

Sustainable resource management embedded in TEK ensures long-term health security. Watts et al. (2017) provide an example of how Inuit marine ethnecology optimises Arctic resource use. Inuit Qaujimajatuqangit (Inuit traditional technology) underpins sustainable Arctic marine harvests, with a 2000 ecological footprint of only 0.20 percent of primary production, far below glo-

bal averages. This low impact reflects millennia of adaptive practices that prioritise ecosystem balance, such as selective species harvesting and seasonal timing.

Garnett et al. (2009) and Jessen et al. (2022) mention the significance of Aboriginal fire management in Australia in maintaining biodiversity, preventing catastrophic wildfires, and protecting food sources, directly contributing to community health and resilience. Cultural burning, or Cool Burning, represents an ancient Aboriginal land management practice utilised for over 60,000 years to mitigate fire hazards, stimulate culturally significant flora regeneration, and protect native wildlife in the country. Distinguished from conventional hazard reduction by significantly lower heat output and seasonally calibrated frequency, it delivers critical ecological benefits, by reducing catastrophic wildfire risk through fuel management, regenerating native flora, preserving fauna habitats, and maintaining canopy integrity, which provides essential shade, refuge from predators and fire, and reduced carbon emissions. Additionally, it stimulates seed germination, enhancing soil and food sources, and offers therapeutic benefits for certain fauna. Crucially, cultural burning sustains Aboriginal and Torres Strait Islander Peoples' connection to the country, facilitates intergenerational transmission of traditional knowledge by elders, and enhances long-term land resilience for dependent communities, underscoring its multifaceted socio-ecological significance. Further, Ladio and Lozada (2009) mention that rural communities in the arid Monte region utilise specific Traditional Ecological Knowledge (TEK) as a sustenance and health buffer during scarcity. Their TEK includes a deep understanding and use of resilient, drought-adapted wild plants like *Prosopis* spp., *Schinus* spp., *Ephedra* spp., *Condalia*, and *Larrea* spp. for both food and medicine. This knowledge provides critical nutrition when other resources fail due to seasonal scarcity or land degradation. Simultaneously, the medicinal use of these plants helps maintain health during challenging periods. Furthermore, their practice of summer cattle transhumance, based on knowledge of landscape patchiness, reduces overgrazing, allowing key wild plants to recover, and facilitates access to a greater diversity and quantity of these edible and medicinal resources across the landscape. This

integrated TEK sustains their food security and health, specifically during times of scarcity.

Diagnosis and Sentinel Monitoring

IK holders possess unparalleled longitudinal observational capacity. For instance, Eckert et al. (2018) observe that the indigenous fishers of British Columbia, Canada, detect subtle ecological shifts, like declining fish size changes in plant phenology or animal behaviour, that serve as early warnings for environmental contamination, ecosystem stress, or climate change impacts with direct human health implications. This “sentinel” function is vital for proactive health protection.

Cultural Continuity as a Health Determinant

The very act of practicing and transmitting TEK reinforces cultural identity, self-esteem, and inter-generational bonds, like powerful protective factors for mental and social well-being. For instance, Isaac et al. (2018) refer to the “Ohero:kon”, a traditional Mohawk rite of passage for adolescents, often called “Under the Husk”. It signifies their transition into adulthood through rigorous physical, mental, and spiritual challenges. Participants undertake fasting, dawn running, cold-water immersion, community service, and learn ancestral teachings from Elders, including language, history, ceremonies, and herbal knowledge. This process instills cultural identity, resilience, discipline, and a deep connection to community, nature, and Creator.

Similarly, Quagasvik is a traditional Yup’ik/Cup’ik rite of passage from Southwest Alaska, guiding adolescents into adulthood. It emphasises learning ancestral survival skills (hunting, fishing, tool-making) alongside core spiritual values like respect for nature (*Ellam Yua*), humility, and community responsibility. Through intensive mentorship from Elders, youth develop resilience, discipline, and environmental stewardship, ensuring sustainable resource use. Both Ohero:kon and Yup’ik/Cup’ik were suppressed by colonisation, however, now revitalised as the core cultural components.

Contemporary Pressures and Vulnerabilities in the Nexus

Contemporary studies reveal that despite resilience, the ecology-health nexus faces intensifying threats. The extent of the issue can be understood from the following scholarly references.

Market Integration Double Bind

Commercialising traditional resources (medicinal plants, wild foods) offers income but risks overexploitation and ecological degradation. Mohd Salim et al. (2023) note the tension, like *Rhododendron* squash sales in India boost income but risk species depletion. Agarwal and Chandra (2021) document 30 percent profit increases but warn of overharvesting without community quotas. Zhao et al. (2023) show Tibetan harvesters face pressure to collect high-value roots destructively due to market demand, conflicting with cultural sustainability values.

Knowledge Erosion Accelerates

Studies reveal that urbanisation, formal education not valuing TEK, youth migration, loss of linguistic terms encoding ecological knowledge, and gendered barriers continue unabated. The passing of elders represents an irreplaceable loss of biocultural libraries (Panghal et al. 2010; Caballero-Serrano et al. 2019; Eshete and Molla 2021).

Climate Change

Uprety et al. (2017) document climate impacts degrading habitats of key medicinal plants like *Asparagus racemosus* in Nepal. Changing weather patterns disrupt traditional harvesting cycles and threaten food and water security (Zhao et al. 2023). Melting permafrost or altered river flows impact sacred sites and traditional travel routes.

Cumulative Burdens

Indigenous health is disproportionately impacted by the synergistic toll of environmental contaminants (often concentrated on or near Indigenous lands), loss of land access, socioeconomic marginalisation, lingering effects of historical trauma, and inadequate healthcare access. Conventional systems struggle to assess or address this complexity (Isaac et al. 2018; Chong et al. 2024).

Ecology, Tribal Lifeways and the Crisis of Well-being in India

The intricate relationship between ecological systems and the health of tribal and indigenous communities across India represents a profound nexus where environmental integrity, cultural

knowledge, and physical, mental and social well-being are inextricably intertwined. Drawing upon a critical synthesis of recent scholarship, this essay argues that ecology functions not merely as a backdrop but as the fundamental determinant of tribal health, constituting an integrated socio-ecological health system. This system encompasses material sustenance, medicinal knowledge, spiritual well-being, and cultural identity, a complex web now critically strained by environmental degradation, state policies, capitalist development, and epistemic injustice, leading to cascading health crises. Understanding this ecology-health nexus is paramount for decolonising health paradigms and advancing genuine health sovereignty for indigenous peoples.

Ecology as Embodied Health Infrastructure: The Foundational Determinant

The compiled literature unequivocally demonstrates that traditional tribal territories and practices constitute a comprehensive health-supporting infrastructure. This relationship manifests through multifaceted pathways.

Material Basis of Well-being

Ecology provides the essential resources underpinning health. TEK is the cornerstone of ethnomedicine, facilitating extensive reliance on local biodiversity. Studies document this reliance across diverse communities, with 128 medicinal plant species used by Gonds and Korkus in Pachmarhi (Kala 2022), 50 among Raji tribes and 35 among Bhargalis (Behera and Kumbhar 2023), and over 62 species utilised by the Chuktia Bhunjia (Sabar and Midya 2022). This positions the local ecosystem as the primary “pharmacy”. Similarly, ecology dictates nutritional security. Wild foods, forest produce, and traditional agricultural systems (for example, rabi/kharif, home gardens) provide dietary diversity and sufficiency, constituting 52 percent of documented plant uses in Pachmarhi (Kala 2022). Dependence on specific resources like Mahua, tubers, and greens among Gonds in Nuapada, Odisha (Majhi and Mohapatra 2022), or the diverse subsistence strategies ensuring food sovereignty documented among Lodha, Santhal, Asur, and Oraon communities (Majumdar and Chatterjee 2021), highlight this

vital link. For communities like the Kadar (“children of the forest”), the ecosystem provides nutritional security, water, medicinal plants, and a physically active lifestyle intrinsically linked to well-being (Xavier 2018).

Shaping Disease Landscapes

Specific ecologies create distinct disease exposures. Forested and hilly terrains foster endemic malaria (“tribal malaria”) due to ideal mosquito breeding conditions (Kanrar et al. 2023; Majhi and Mohapatra 2022). Geological factors like alkaline rocks cause endemic fluorosis in specific Nuapada blocks (Majhi and Mohapatra 2022). Water scarcity or contamination in remote areas (hill streams, stagnant water) drives waterborne diseases (diarrhoea, dysentery, parasitism) universally noted (Majhi and Mohapatra 2022; Kanrar et al. 2023; Mahadevan and Kannadasan 2023). Genetic disorders like sickle cell anaemia are linked to genetic isolation within specific ecological niches (Mahadevan and Kannadasan 2023).

Cultural Ontology, Health Beliefs, and Spiritual Well-being

Health perceptions and etiologies are deeply embedded within ecological worldviews. Illness is often attributed to supernatural forces (displeased deities/spirits, evil eye, black magic) intrinsically linked to the natural environment (Dhanjal and Sharma 2022; Majhi and Mohapatra 2022; Mahadevan and Kannadasan 2023). Rituals (for example, Gond Gunia appeasement, Warli Koval bhoji for wild vegetables, Chuktia Bhunjia “biosacred” healing) mediate health-ecology links, embedding well-being within frameworks of ecological reverence and reciprocity (Nimbalkar and Tapiawala 2021; Kala 2022; Sabar and Midya 2022). Sacred groves (Sarna Sthals) are particularly significant “lifeworlds”, conserving biodiversity (including medicinal species) and serving as sites for spiritual healing, community cohesion, and maintaining harmony with nature and ancestral spirits, collectively underpinning physical, mental, and social health (Kala 2022; Tirkey et al. 2024). This integration of material and spiritual realms forms a holistic health system.

Ecoliteracy as Preventive Healthcare

Majumdar and Chatterjee (2021) operationalise “ecoliteracy” as applied health knowledge among tribes in eastern India. High levels of ecoliteracy are strongly correlated with forest dependency, and they encompass sustainable harvesting of medicinal plants, traditional agriculture minimising toxic exposure, and diverse subsistence strategies. This knowledge, predominantly transmitted intergenerationally, functions as preventative healthcare and a buffer against malnutrition and disease (Majumdar and Chatterjee 2021). Kumar and Sahoo (2019) frame the Adivasi “agro-forestry economy” as a “socio-natural system”, where land, forests, water, and sacred landscapes are the bedrock of nutrition, medicine, cultural identity, and psychosocial well-being, the essence of health infrastructure (Kumar and Sahoo 2019).

Ecological Disruption as the Primary Driver of Health Vulnerability and Transition

The vital ecology-health nexus is under relentless assault, severing lifelines and triggering cascading health crises.

Severing the Material Lifeline

Displacement, deforestation, habitat degradation, and restrictive policies (for example, flawed Forest Rights Act implementation, Wildlife Protection Act restrictions, declaration of reserves like Sunabeda tiger reserve) directly sever access to the biodiversity underpinning traditional medicine and nutrition (Xavier 2018; Kala 2022; Negi and Azeez 2022; Sabar and Midya 2022; Kanrar et al. 2023). This forces reliance on nutritionally poor market foods and inaccessible or culturally inappropriate modern healthcare, worsening malnutrition. For instance, the chronic energy deficiency (CED) rates are more than 88 percent among Odisha PVTGs (Kanrar et al. 2023), and it is hindering NCD (non-communicable diseases) management. Xavier (2018) statistically confirms the link between forest resource drain and malnutrition among the Kadar ($p < .001$).

Forced Detachment, Migration and the Epidemiological Transition

Degradation of traditional resource bases drives migration for employment and education

(Kanrar et al. 2023). Majumdar and Chatterjee (2021) establish that “detachment from forest and natural resources is detrimental to the preservation and cultivation of ecoliteracy”, acting as a health risk multiplier. Urban environments introduce drastic changes, like altered diets (processed foods), reduced physical activity, increased stress, and exposure to new pollutants and diseases (HIV/AIDS) (Xavier 2018; Majhi and Mohapatra 2022; Kanrar et al. 2023). This shift is the primary vector for the “epidemiological transition”, manifesting as the dual burden of persistent communicable diseases (like malaria and TB) and rapidly rising non-communicable diseases (like, hypertension, diabetes, obesity) alongside psychosocial distress like alcoholism (Xavier 2018; Kanrar et al. 2023; Mahadevan and Kannadasan 2023). Kumar and Sahoo (2019) frame dispossession from the socio-natural base as “health dispossession”.

Erosion of TEK

Globalisation, cultural homogenisation, declining traditional occupations (for example, shifting cultivation, snake charming criminalised) (Halder 2018), youth disengagement (“extinction of experience”), lack of documentation, and the negative correlation of formal education with ecoliteracy (Majumdar and Chatterjee 2021) lead to the intergenerational loss of ethnomedical knowledge and sustainable resource management practices (Nimbalkar and Tapiawala 2021; Kala 2022; Negi and Azeez 2022; Behera and Kumbhar 2023). This “cultural distortion” erodes a critical health resilience system (Negi and Azeez 2022).

Environmental Degradation Feedback Loops and Industrial Assault

Unhygienic practices (open defecation, improper waste disposal), stemming from poverty and lack of infrastructure, pollute water sources and soil, causing waterborne/parasitic diseases and creating vector breeding grounds (Majhi and Mohapatra 2022). State-backed industrialisation and mining (“developmentalism”) enact “accumulation by dispossession” (Harvey 2003), forcibly separating Adivasis from land and water, causing direct health hazards (pollution, for example of the Brahmani River), loss of biodiversity, profound psychosocial stress, and violence (Kumar and Sahoo 2019).

Unsustainable commercialisation (for example, chemicals for gum extraction) depletes species (Kala 2022), while industrial pollution contaminates resources (Nimbalkar and Tapiawala 2021).

Epistemic Injustice and Gendered Exclusion

A critical threat is the erasure of indigenous knowledge systems and the specific marginalisation of women. Epistemic injustice silences Adivasi worldviews, particularly women's knowledge as healers (*Bhagatain*) and ecological stewards within sacred groves, directly undermining health sovereignty (Tirkey et al. 2024). "Healthcare apartheid" for women arises through pollution taboos barring access to sacred/medicinal sites, biomedical exclusion via customary laws, and patrilineal knowledge transmission erasing female-centric ethnomedicine (Sabar and Midya 2022). This gendered exclusion severely constrains health access and agency.

Nuances of Vulnerability and Differential Impact

The health impacts of ecological disruption are not uniform, shaped by specific socio-ecological contexts.

Habitat Specificity

Remoteness creates extreme vulnerability. Particularly Vulnerable Tribal Groups (PVTGs) in isolated hilltops or dense forests (for example, Hill Korwa, Juang) face extreme healthcare inaccessibility, greater nutritional insecurity, and heightened exposure to environmental hazards compared to less remote tribes or migrants (Dhanjal and Sharma 2022; Kanrar et al. 2023; Mahadevan and Kannadasan 2023). The malnutrition-related death of the Juang children in Nagada exemplifies this deadly intersection (Kanrar et al. 2023). Contrarily, tribes on urban peripheries experience ecological degradation, acculturation pressures, and limited access to *both* traditional and modern health resources, heightening susceptibility to NCDs and mental health stresses (Kanrar et al. 2023).

Socio-ecological Poverty

Poverty, low literacy (especially maternal), landlessness, poor housing, and lack of sanitation powerfully intersect with ecological challenges (remoteness, degraded resources) to compound vulnerabilities (Bhasin 2005; Nimbalkar and Tapiawala 2021; Majhi and Mohapatra 2022; Mahadevan and Kannadasan 2023).

Critique of Policy and Systemic Failures: Ecological Blindness and Structural Hypocrisy

Research and evaluation of systemic initiatives towards tribal health and ecosystem reveal that the mainstream systems consistently fail and often exacerbate the crisis. The following examples elucidate the point.

Ecological Blindness

Studies have shown that in India, the health policies fundamentally ignore ecological determinants. Infrastructure (PHCs, sub-centres) is built without addressing geographical inaccessibility or staff unwillingness to serve remote areas (Nimbalkar and Tapiawala 2021; Majhi and Mohapatra 2022; Mahadevan and Kannadasan 2023). Schemes like National Health Mission subsume tribal needs under generic "rural health", ignoring habitat-specific challenges and cultural cosmologies (Negi and Azeez 2022; Kanrar et al. 2023).

Neglect and Co-optation of TEK

While calls exist for "tribe-specific" approaches and TEK integration, policies lack concrete mechanisms. TEK remains undocumented, unregulated, and marginalised. Proposals risk co-opting knowledge without granting land rights, governance autonomy, or ensuring sustainable harvesting (Kala 2022; Negi and Azeez 2022). Calls for "scientific research" often lack proposals for equitable benefit-sharing or tribal-led validation (Kanrar et al. 2023).

Structural Violence and Hypocrisy

Policies exhibit structural hypocrisy. "Forest protection" laws restrict tribal foraging while enabling corporate extraction, enabling ecological knowledge extinction (Kala 2022; Negi and Azeez

2022). Development projects displace without viable alternatives. Urban-centric healthcare “siphons resources away” from rural tribal needs (Bhasin 2005). Conservation policies criminalise traditional livelihoods (like those of Bediya snake charmers), destroying economies and vital knowledge (Halder 2018).

Cultural Dissonance in Healthcare Delivery

Modern systems ignore or dismiss tribal health beliefs, creating distrust and reducing uptake (Majhi and Mohapatra 2022; Behera and Kumbhar 2023). This insensitivity exacerbates reliance on unqualified practitioners (estimated 64%) (Negi and Azeez 2022) and constitutes “neocolonial displacement” of traditional systems (Sabar and Midya 2022).

Synthesising Global and Indian Pathways to Decolonising Health and Ecocultural Sovereignty

Shared Foundational Principles: Land, Knowledge Sovereignty and Decolonised Systems as Health Imperatives

The global discourse and the Indian context converge unequivocally on the fundamental principle that indigenous/tribal health is inextricably bound to land sovereignty and self-determination. Securing rights to traditional territories and supporting community-led stewardship are not merely environmental or cultural goals, as they constitute the bedrock of healthcare itself. Globally, this manifests through Indigenous Protected Areas (IPAs) and Guardian programs, proven to sustain cultural knowledge (Tjukurpa), enable intergenerational transfer, and directly foster well-being through active care for a country. India’s parallel struggle centres on the effective implementation of the Forest Rights Act (FRA), recognising that legal security over land and forests is non-negotiable for accessing vital medicinal resources and maintaining culturally grounded health practices. Both contexts affirm that Indigenous Natural and Cultural Resource Management (ICNRM) on ancestral homelands yields demonstrably superior health and ecological outcomes compared to imposed, centralised models. Furthermore, true health sovereignty demands

centering data and intellectual property rights. Global frameworks like OCAP® principles (Ownership, Control, Access, Possession) (FNIGC 2024) and United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (UN 2007) implementation in legislation (for example, Canada’s CEPA) find resonance in India’s urgent need for tribal-led documentation of Traditional Ecological Knowledge (TEK) with guaranteed data sovereignty and protection of medicinal IP. This necessitates a radical decolonisation of healthcare systems globally and in India, moving beyond tokenism towards epistemological reconciliation. This requires mandatory cultural safety and humility training for all health providers, respectful partnerships with traditional healers (for example, FNHA programs, recognition within Indian public health policy), and the development of healthcare models and Indigenous Health Indicators (IHIs) that reflect holistic, culturally congruent concepts of well-being (for example, Te Whare Tapa Whā in NZ, integrating ethnomedicine respectfully in India via trained ASHAs+ and tribal youth bridges).

Distinctive Emphases: India’s Pursuit of Ecocultural Health Sovereignty and Contextual Justice

While grounded in shared principles, India’s pathway articulates a distinct and forceful demand for ecocultural health sovereignty, explicitly framing ecological justice as health justice. This necessitates confronting unique structural violences and designing hyper-local solutions. A critical emphasis is gender justice, recognising women as pivotal custodians of ecological and health knowledge. India specifically calls for training female Community Health Workers (CHWs) as systemic bridges and actively supporting women’s leadership in movements revitalising sacred ecologies (for example, Sarna groves), fostering “compassionate solidarity” to dismantle exclusionary practices. Addressing the root causes of ecological and health devastation is paramount. India’s context demands relentless combat against industrial pollution, unsustainable extraction, deforestation, and land alienation, with legacies of state hypocrisy and capitalist dispossession requiring ecological reparations. This includes investing in ecologically sound water

security, sanitation, nutrition programs based on local food sovereignty, and housing. Crucially, achieving health equity requires habitat-specific and tribe-specific co-design. Interventions cannot be generic. They must be deeply rooted in the understanding of specific ecological niches, disease ecologies, nutritional patterns, and cultural beliefs of diverse tribal communities. This demands co-designing solutions *with* tribes, investing in tribal youth as “biodiversity stewards”, and developing context-sensitive infrastructure like mobile clinics, telemedicine, and robust support for local health workers, ensuring culturally resonant alternative livelihoods during transitions.

The Unifying Imperative: Biocultural Resurgence as the Path to Health for People and Planet

The resounding conclusion from both global and Indian analyses transcends geographical boundaries, and “Healthy Country is Healthy People” is an ontological truth, not a slogan. Health for Indigenous and tribal peoples is not passively influenced by the environment, it is actively co-constituted within specific biocultural landscapes governed by kinship and reciprocity. Colonialism inflicted its deepest wounds by systematically rupturing these vital relationships, severing people from land, suppressing languages and knowledge systems, and imposing alien governance and health paradigms. Consequently, healing the profound health disparities experienced by these communities is inseparable from healing the country and restoring sovereignty over lands, knowledge, and cultural practices. Efforts confined solely to biomedical interventions or isolated environmental conservation are inherently inadequate and perpetuate colonial fragmentation. True progress demands a fundamental paradigm shift towards biocultural resilience. Protecting ecological integrity *with* its cultural knowledge (biocultural conservation), revitalising and respecting TEK within self-determined systems, securing land rights, ensuring justice (including gender justice), and co-designing meaningful healthcare are not merely ethical choices. They are essential, interconnected strategies for achieving health equity and environmental sustainability in an era of converging crises. Whether framed as global “decolonising

health through biocultural resurgence” or India’s “ecocultural health sovereignty”, the prescription is clear, supporting Indigenous and tribal leadership in stewarding their lands and knowledge is the most profound path to healing both people and the planet.

DISCUSSION

The findings from the blend of global and indigenous scholarship reveal an indisputable truth that says “ecological justice is health justice”. The relationship between Indigenous well-being and the natural world is not merely correlational but ontologically constitutive, embedded in reciprocal kinship systems that colonialism systematically ruptured and that contemporary policies continue to undermine. Below, the researchers engage deeply with the evidence to elucidate the complexities of this relationship, its historical destruction, and the pathways toward restorative justice.

Ontological Foundations: Health as Relational Harmony

At the core of Indigenous health systems lies a “kincentric ontology”, a worldview that positions humans as part of an animate, interconnected web of life. Salmon’s (2000) work on the Rarámuri concept of *iwigara* (shared breath) illustrates that health (*iví*) arises from harmonious relationships with plants, animals, and landscapes. Similarly, Robin et al. (2022) describe how Australian Aboriginal *Tjukurpa* (Dreaming Law) mandates that well-being is inseparable from caring for a country, a practice that sustains physical activity, nutritional security, and spiritual fulfillment.

Biomedical reductionism isolates health from ecological and cultural contexts, and the “kincentric ontology” based systems challenge biomedical reductionism. Tyagi (2024) notes that indigenous healing practices, such as the Huichol *yúmarí* ceremony or Māori midwifery, address root causes (relational imbalances) rather than just symptoms. Yet Western medicine often dismisses these frameworks as “primitive”, exacerbating healthcare disparities (Isaac et al. 2018). Redvers and Blondin (2020) document cases where physicians openly disparage traditional healers, deepening mistrust in clinical systems.

This epistemic violence demands more than superficial “integration”, and it requires decolonising health paradigms by centering indigenous sovereignty in defining well-being (Gone 2016).

Colonial Rupture: The Roots of Health Trauma

Findings from the literature indicate that colonialism did not merely disrupt Indigenous health systems, it weaponized ecological destruction as a tool of control. The forcible removal of indigenous peoples from ancestral lands severed access to medicinal plants and traditional food systems, triggering epidemics of diabetes and cardiovascular disease (Turner et al. 2022). In Canada, bans on the Potlatch ceremony and the residential school system deliberately targeted knowledge transmission, creating intergenerational trauma (Redvers and Blondin 2020). In India, criminalising snake charming (Panghal et al. 2010) and restricting forest access under the Wildlife Protection Act have eroded ethnomedical systems while enabling corporate extraction (Halder 2018; Kala 2022). There are, however, ethical reasons behind the ban on snake charming. Nevertheless, considering a community’s dependence on this occupation, it could have been handled in a non-coercive manner.

The findings from the literature review reveal quantifiable impacts of ecological destruction. For instance, displacement from traditional diets to processed foods correlates with soaring NCD rates (Garnett et al. 2009), producing a nutritional trauma among the indigenous communities. Further, the loss of cultural practices like the Mohawk *Ohero:kon* rite of passage undermines identity and resilience (Isaac et al. 2018), leading to mental health crises. Finally, in the gender domain of the indigenous communities, colonial policies amplified patriarchal structures, marginalising women healers (*Bhagatain*) and disrupting matrilineal knowledge transfer (Tirkey et al. 2024), leading to a condition of gendered violence.

Today, the socio-political and administrative structure seems to be working in a hypocritical way. For instance, while India’s Forest Rights Act (2006) nominally recognises tribal land rights, its flawed implementation has left PVTGs (Particularly Vulnerable Tribal Groups) with chronic energy deficiency rates exceeding 88 percent (Kanrar et al. 2023). Similarly, Canada’s Bill S-5 prioritises

industrial development over Indigenous sovereignty, perpetuating health dispossession (Negi and Azeez 2022).

TEK as Living Resistance

The literature review reveals that Traditional Ecological Knowledge (TEK) is a dynamic system of resilience rather than a static relic. In the global scenario, one can see it as a process of preventive healthcare, diagnostic tools, and a mechanism of cultural continuity. For instance, the aboriginal fire management in Australia reduces catastrophic wildfires, protecting food sources and biodiversity (Jessen et al. 2022). Sometimes, the TEK may be used as a diagnostic tool, as one can see among the Inuit fishers detect ecological shifts (for example, declining fish size) that serve as early warnings for environmental contamination (Eckert et al. 2018). TEK also serves as a mechanism of cultural continuity, as one can see how the revitalised rites of passage (for example, Yup’ik *Quagavik*) rebuild intergenerational bonds shattered by colonialism (Isaac et al. 2018).

Indian literature indicates that TEK sustains a material and spiritual health infrastructure through ethnomedicine, as one can see among the Chuktia Bhunjias, who use 62+ plant species for healthcare, with women playing key roles in knowledge transmission (Sabar and Midya 2022). Sustainable foraging practices among Gonds and Korkus show their ecoliteracy that helps them buffer malnutrition (Majumdar and Chatterjee 2021).

Yet market pressures threaten these systems. Commercial demand for *Rhododendron* squash in India risks overharvesting, while Tibetan communities face conflicts between market-driven root extraction and cultural sustainability norms (Zhao et al. 2023). TEK cannot be commodified without community-led safeguards that prioritise ecological balance over profit.

Converging Crises: Climate Change and Cumulative Burdens

Indigenous health is disproportionately impacted by synergistic stressors. For instance, there are instances of habitat loss due to climate shifts that degrade medicinal plants like *Asparagus racemosus* in Nepal (Upriety et al. 2017). Toxic

legacies are evident in indigenous domains such as mining pollution in Canada's Giant Mine area, which compounds historical trauma with heavy metal exposure (Sandlos and Keeling 2016). Apartheid healthcare among the PVTGs in India has been evident through the study of Majhi and Mohapatra (2022), which reveals that in remote Indian hilltops, the PVTGs face dual burdens of waterborne diseases and clinical inaccessibility.

Further, the distortion of ceremonial traditions leads to the failure of conventional risk assessment catastrophically, while it ignores the cultural exposure pathways. It may result in the cumulative impact of environmental toxins, historical trauma, and poverty, as Chong et al. (2024) reveal. However, Watts et al. (2017) demonstrate that indigenous-led frameworks, like the Inuit-developed *Inuit Qaujimajatuqangit*, offer alternatives by centering relational health metrics.

Decolonising Health: Pathways Forward

The literature review strongly indicates that to understand and enhance the total health and well-being of indigenous peoples, the decolonisation of health is the utmost requirement. Scholars have found that there are several ways towards decolonising health, mostly through indirect means. An Australian study by Robin et al. (2022) finds that restoring Indigenous land rights works as a preventive medicine. Walalkara IPA in Australia shows how cultural stewardship reduces diabetes rates. Similarly, the study conducted by Negi and Azeez (2022) in India demonstrates that effective FRA implementation could reverse malnutrition crises. Further, the epistemology of healthcare must align with the indigenous beliefs and practices, that is, it should be culture sensitive, incorporating a pluralistic system, as Tyagi (2024) observed that New Zealand's *Te Whare Tapa Whā* model integrates spiritual health into clinical care, improving Māori health outcomes. Scholars like Tirkey et al. (2024) hint at the importance of gender justice in healthcare against the male-centric epistemology of healthcare, supporting women healers (*Bhagatain*) through initiatives like Sarna grove revitalisation.

Biocultural Resurgence as Imperative

The scholarly evidence discussed above proves without doubt that the ecological violence, mostly perpetrated by the colonial legacy, is an

other form of health violence. Healing in indigenous populations requires dismantling the structural hypocrisy that is present in the present-day system, and it must make indigenous health sovereignty a central theme. It must be established as the only ethical and effective path to health equity, rather than awarding it as a concession. As Langaliki Robin asserts, *Ngamana Tjukurpa kuwarri kunpu kanyini* ("We are now taking strong care of our culture") is both an act of resistance and a prescription for planetary survival. The task ahead is clear, repair the ruptured kinship ties between people and the country, for in their restoration lies the future of health justice.

CONCLUSION

The findings and the discussions accentuate the profound interdependence between ecological integrity and indigenous health, asserting that ecological justice is inseparable from health justice. It highlights how TEK embodies a kincentric ontology, where health is rooted in reciprocal relationships with land, ancestors, and more-than-human kin. Colonialism's violent severance of this biocultural nexus, through land dispossession, cultural suppression, and epistemic violence, has precipitated intergenerational health trauma, manifesting as nutritional deprivation, non-communicable diseases, and mental health crises. In India, deforestation, industrialisation, and restrictive policies have exacerbated these disparities, particularly marginalising women healers and eroding TEK. The paper positions TEK as a vital framework for health sovereignty, enabling preventive care, environmental monitoring, and culturally grounded resilience. To address these challenges, it calls for land repatriation, Indigenous-led biocultural conservation, healthcare models that reconcile TEK with biomedicine, and policy reforms centering Indigenous data sovereignty and gender justice. Ultimately, the conclusion emphasises that healing Indigenous communities necessitates restoring their relationship with the land, affirming that "Healthy Country is Healthy People" is not merely a slogan but an ontological truth demanding transformative action.

RECOMMENDATIONS

The critical gaps in operationalising biocultural approaches to health justice, revealed by the review, demand immediate and focused re-

search action. While the foundational links between ecology, Traditional Ecological Knowledge (TEK), and Indigenous health are established, transformative pathways require evidence rigorously co-created *with* communities. Therefore, the following recommendations may be made.

It is necessary to initiate collaborative research with tribes actively reclaiming ancestral territories. This research must track tangible changes in nutritional diversity, disease burden, and cultural continuity utilising community-defined Indigenous Health Indicators (IHIs).

One must urgently co-design novel environmental risk assessment frameworks with Indigenous scholars. These models must integrate kin-centric metrics alongside, or instead of, conventional biomedical endpoints. Piloting these models in high-pressure zones is a critical next step.

Action-oriented ethnographic research, conducted alongside women-led collectives (for example, Sarna sacred grove conservators), is vital to systematically map the tangible trade-offs between income generation activities and TEK erosion. There is also a need for effective strategies for sustaining intergenerational knowledge transmission amidst increasing commercialisation pressures.

One must implement rigorous mixed-methods studies to examine key complexities, specifically the hybrid health-seeking behaviours, such as the concurrent use of Ayurveda, TEK, and biomedicine. One must rely on innovative models of “biodiversity stewardship” emerging within degraded landscapes (for example, the maintenance of medicinal species in urban sacred groves).

It is imperative to integrate deep TEK with sophisticated ecological modelling to achieve two crucial objectives. One, identifying climate-refugia for culturally critical medicinal plant species, and two, co-developing robust “biocultural conservation” protocols, including strategies like the assisted migration of species vital to cultural continuity and health.

This sequential research agenda represents the non-negotiable pathway to generating the evidence required for achieving genuine health justice through operationalised biocultural approaches. Each step requires a committed partnership and co-creation with Indigenous communities and scholars.

REFERENCES

- Agarwal R, Chandra V 2021. Diversity and multipurpose utility of wild edible plants in Chopta–Mandal Forest, Uttarakhand. *International Journal of Life Science and Pharma Research*, 11(2): L30–L37. <https://doi.org/10.22376/ljpb8/lpr.2021.11.2.L30-37>
- Behera S, Kumbhar RK 2023. Tribal Health Care in India: A Systematic Review of Practices and Beliefs. *International Research Journal of Social Sciences*, 12(3): 61–65. From <<https://www.isca.me/IJSS/Archive/v12/i3/9.ISCA-IRJSS-2023-011.pdf>> (Retrieved on 1 June 2025).
- Bhasin V 2005. Ecology and Health: A Study Among Tribals of Ladakh. *Studies of Tribes and Tribals*, 3(1): 1–13. From <<http://krepublishers.com/02-Journals/T%20and%20T/T%20and%20T-03-0-000-000-2005-Web/T%20and%20T-03-1-000-000-2005-Abst-PDF/T%20and%20T-03-1-001-013-2005-036-Bhasin-V/T%20and%20T-03-1-001-013-2005-036-Bhasin-V-Full-Text.pdf>> (Retrieved on 1 June 2025).
- Caballero-Serrano V, McLaren B, Carrasco JC, Alday JG, Fiallos L, Amigo J, Onaindia M 2019. Traditional ecological knowledge and medicinal plant diversity in Ecuadorian Amazon home gardens. *Global Ecology and Conservation*, 17: e00524. <https://doi.org/10.1016/j.gecco.2019.e00524>
- Chong K, Hickey GM, Chan HM, Basu N 2024. Exploring practices, challenges, and priorities for human health and ecological risk assessments in Indigenous communities in Canada. *Integrated Environmental Assessment and Management*, 20(5): 1677–1692. <https://doi.org/10.1002/ieam.4927>
- Derso YD, Kassaye M, Fassil A, Derebe B, Nigatu A, Ayene F, Tamer M, Van Damme P 2024. Composition, medicinal values, and threats of plants used in indigenous medicine in Jawi District, Ethiopia: Implications for conservation and sustainable use. *Scientific Reports*, 14: 23638. <https://doi.org/10.1038/s41598-024-71411-5>
- Dhanjal HS, Sharma KKN 2022. Indigenous knowledge pertaining to health, illness and healthcare seeking behaviour among tribes of Chhattisgarh, India: A comparative explanation. *Asian Journal of Interdisciplinary Research*, 5(3): 16–21. <https://doi.org/10.54392/ajir2232>
- Eckert LE, Ban NC, Frid A, McGreer M 2018. Diving back in time: Extending historical baselines for yelloweye rockfish with Indigenous knowledge. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 28(1): 158–166. <https://doi.org/10.1002/aqc.2834>
- Eshete MA, Molla EL 2021. Cultural significance of medicinal plants in healing human ailments among Guji semi-pastoralist people, Suro Barguda District, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 17(1): 61. <https://doi.org/10.1186/s13002-021-00487-4>
- First Nations Information Governance Centre FNIGC 2024. The First Nations Principles of OCAP®. From <<https://fnigc.ca/ocap>> (Retrieved on 1 June 2025).
- Garnett ST, Sithole B, Whitehead PJ, Burgess CP, Johnston FH, Lea T 2009. Healthy country, healthy people: Policy implications of links between Indigenous human health and environmental condition in tropical Australia.

- Australian Journal of Public Administration*, 68(1): 53-66. <https://doi.org/10.1111/j.1467-8500.2008.00609.x>
- Gone JP 2016. Alternative knowledges and the future of community psychology: Provocations from an American Indian healing tradition. *American Journal of Community Psychology*, 58(3-4): 314-321. <https://doi.org/10.1002/ajcp.12046>
- Halder S 2018. Political ecology of snake charming: Evidence from West Bengal, India. *South Asian Survey*, 24(1): 54-87. <https://doi.org/10.1177/0971523118783373>
- Harvey D 2003. *Accumulation by Dispossession- The New Imperialism*. Oxford. Online Edition. From <<https://doi.org/10.1093/oso/9780199264315.003.0007>> (Retrieved on 1 June 2025).
- Isaac G, Finn S, Joe JR, Hoover E, Gone JP, Lefthand-Begay C, Hill S 2018. Native American perspectives on health and traditional ecological knowledge. *Environmental Health Perspectives*, 126(12): 125002. <https://doi.org/10.1289/EHP1944>
- Jessen TD, Ban NC, Claxton NX, Darimont CT 2022. Contributions of Indigenous Knowledge to ecological and evolutionary understanding. *Frontiers in Ecology and the Environment*, 20(2): 93-101. <https://doi.org/10.1002/fee.2435>
- Kala CP 2022. Traditional ecological knowledge of tribal communities and sustainability of nature and natural resources in Pachmarhi Biosphere Reserve in India. *International Journal of Ecology*, Paper ID 5979024. <https://doi.org/10.1155/2022/5979024>
- Kanrar P, Goswami M, Roy S 2023. Health issues of the indigenous communities with special reference to the Particularly Vulnerable Tribal Groups (PVTGs) of Odisha: A review. *Papers on Anthropology*, 32(1): 45-80. <https://doi.org/10.12697/poa.2023.32.1.05>
- King M, Smith A 2000. Indigenous health part 2: The underlying causes of the health gap. *The Lancet*, 356(9233): 1753-1757. [https://doi.org/10.1016/S0140-6736\(09\)60827-8](https://doi.org/10.1016/S0140-6736(09)60827-8)
- Kumar D, Sahoo D 2019. Natural resources matter: Capitalism and people's resistance against developmentalism in the Adivasi region of India. *The Oriental Anthropologist*, 19(1): 83-101. <https://doi.org/10.1177/0972558X19835373>
- Ladio AH, Lozada M 2009. Human ecology, ethnobotany, and traditional practices in rural populations inhabiting the Monte region: Resilience and ecological knowledge. *Journal of Arid Environments*, 73(2): 222-227. <https://doi.org/10.1016/j.jaridenv.2008.02.006>
- Mahadevan B, Kannadasan K 2023. Health Status of the Tribal Communities in Tamil Nadu: A Literature Review. *International Research Journal of Education and Technology*, 5(3): 159-169. From <<https://www.irjweb.com/HEALTH%20STATUS%20OF%20THE%20TRIBAL%20COMMUNITIES%20IN%20TAMIL%20NADU%20%20A%20LITERATURE%20REVIEW.pdf>> (Retrieved on 1 June 2025).
- Majhi H, Mohapatra R 2022. Tribal health care system of the Gonds of Nuapada District of Odisha in India. *International Journal of Health Sciences*, 6(S1): 10653-10672. <https://doi.org/10.53730/ijhs.v6nS1.7548>
- Majumdar K, Chatterjee D 2021. Ecoliteracy among tribals in Eastern India. *South Asia Research*, 42(1): 76-92. <https://doi.org/10.1177/0267280211056838>
- Mohd Salim J, Anuar SN, Omar K, Tengku Mohamad TR, Sanusi NA 2023. The impacts of traditional ecological knowledge towards indigenous peoples: A systematic literature review. *Sustainability*, 15(1): 824. <https://doi.org/10.3390/su15010824>
- Negi DP, Azeez EPA 2022. Diminishing traditional methods and inaccessible modern healthcare: The dilemma of tribal health in India. *Journal of Health Research*, 36(5): 867-877. <https://doi.org/10.1108/JHR-01-2021-0001>
- Nimbalkar N, Tapiawala M 2021. Environmental Dimensions of Tribal Sustainability: An Analysis of belief systems and Economic Status of Warlis and Dhor Kolis in Palghar and Thane District. *Sambhāca*, 3(1): 223-238. From <<https://mu.ac.in/wp-content/uploads/2022/09/223-238-Environmental-Dimensions-of-Tribal-Sustainability.pdf>> (Retrieved on 1 June 2025).
- Pan SY, Litscher G, Gao SH, Zhou SF, Yu ZL, Chen HQ, Zhang SF, Tang MK, Sun JN, Ko KM 2014. Historical perspective of traditional indigenous medical practices: The current renaissance and conservation of herbal resources. *Evidence-Based Complementary and Alternative Medicine*, Paper 525340. <https://doi.org/10.1155/2014/525340>
- Panghal M, Arya V, Yadav S, Kumar S, Yadav JP 2010. Indigenous knowledge of medicinal plants used by the Saperas community of Khetawas, Jhajar District, Haryana, India. *Journal of Ethnobiology and Ethnomedicine*, 6(4). <https://doi.org/10.1186/1746-4269-6-4>
- Redvers N, Blondin B 2020. Traditional Indigenous medicine in North America: A scoping review. *PLOS ONE*, 15(8): e0237531. <https://doi.org/10.1371/journal.pone.0237531>
- Robin L, Robin K, Camerlenghi E, Ireland L, Ryan-Colton E 2022. How Dreaming and Indigenous ancestral stories are central to nature conservation: Perspectives from Walalkara Indigenous Protected Area, Australia. *Ecological Management and Restoration*, 23(S1): 44-52. <https://doi.org/10.1111/emr.12528>
- Sabar B, Midya DK 2022. Encountering illness: Local knowledge, institutions and the science of healthcare practices among the Chuktia Bhunjia tribe of Odisha, India. *Journal of Asian and African Studies*, 58(7): 1349-1372. <https://doi.org/10.1177/00219096221086541>
- Salmon E 2000. Kincentric ecology: Indigenous perceptions of the human-nature relationship. *Ecological Applications*, 10(5): 1327-1332. [https://doi.org/10.1890/1051-0761\(2000\)010\[1327:KEIPOT\]2.0.CO;2](https://doi.org/10.1890/1051-0761(2000)010[1327:KEIPOT]2.0.CO;2)
- Sandlos J, Keeling A 2016. Toxic legacies, slow violence, and environmental injustice at Giant Mine, Northwest Territories. *Northern Review*, 42: 7-21. <https://doi.org/10.22584/nr42.2016.002>
- Tirkey NN, Ekka KT, Soren S, Soren S 2024. Adivasi women, sacred groves and religious practices: Unveiling the epistemic injustice in the east-central belt of India. *Sociological Bulletin*, 73(4): 481-493. <https://doi.org/10.1177/00380229241287432>
- Turner NJ, Cuerrrier A, Joseph L 2022. Well grounded: Indigenous Peoples' knowledge, ethnobiology and sustainability. *People and Nature*, 4(4): 627-651. <https://doi.org/10.1002/pan3.10321>
- Tyagi R 2024. The Role of Indigenous Knowledge in Sustainable Health Practices. *IHRDI Journal of Sustain-*

- able Development*, 1(1): 14-27. From <<https://qtanalytics.in/journals/index.php/IJSD/paper/view/4394>> (Retrieved on 1 June 2025).
- UN 2007. United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). From <<https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenous-peoples.html>> (Retrieved on 1 June 2025).
- Upirey Y, Shrestha UB, Rokaya MB, Shrestha S, Chaudhary RP, Thakali A, Cockfield G, Asselin H 2017. Perceptions of climate change by highland communities in the Nepal Himalaya. *Climate and Development*, 9(7): 649-661. <https://doi.org/10.1080/17565529.2017.1304886>
- Watts P, Koutouki K, Booth S, Blum S 2017. Inuit Food Security in Canada: Arctic Marine Ethnoecology. *Food Security*, 9(3): 421-440. <https://doi.org/10.1007/s12571-017-0668-0>
- Xavier S 2018. The problems and challenges of the Kadar tribe of Kerala. *Contemporary Voice of Dalit*, 10(2): 204-215. <https://doi.org/10.1177/2455328X18785454>
- Zhao J, Fan L, Hu S, Poha, Jiayangji, Wan AKY, Zeng Y, Yang Y, Duan B, Lee TM 2023. Understanding indigenous people's traditional Chinese medicinal plants harvesting preferences to guide sustainable management. *People and Nature*, 5: 1174-1186. <https://doi.org/10.1002/pan3.104>

Paper received for publication in June, 2024
Paper accepted for publication in August, 2025