



CONCEPTUAL

HARNESSING INDIGENOUS KNOWLEDGE AS A NATURE-BASED SOLUTION IN POST-WAR SUDAN: HEALING PEOPLE AND ECOSYSTEMS

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ABSTRACT

PURPOSE: This paper explores how indigenous knowledge (IK), particularly traditional medicine, can function as a nature-based solution (NBS) in Sudan's post-war reconstruction. It highlights the dual potential of traditional healing systems in restoring human health and conserving biodiversity, thus supporting both socio-cultural resilience and ecological recovery.

DESIGN/METHODOLOGY/APPROACH: A multidisciplinary approach is used, combining historical context, ethnobotanical insights, and policy analysis. The paper draws from Sudanese case studies, international experiences, and legal frameworks to assess the integration of traditional medicine into primary healthcare and environmental stewardship.

FINDINGS: IK offers cost-effective, culturally accepted healthcare in under-served areas and promotes the conservation of medicinal plants and ecosystems. However, regulatory gaps, overharvesting, and lack of institutional support limit its full potential as an NBS.

ORIGINALITY/VALUE: The paper introduces a novel perspective by framing traditional medicine as a connector between human and ecosystem health in post-conflict Sudan. It suggests policy pathways for integrated reconstruction.

RESEARCH LIMITATIONS/IMPLICATIONS: Challenges include fragmented data, lack of standardised studies on efficacy and safety, and weak documentation of traditional practices.

PRACTICAL IMPLICATIONS: The paper provides actionable guidance for policy-makers, practitioners, and conservationists to enhance healthcare access, cultural preservation, and biodiversity protection.

KEYWORDS: *Traditional Medicine; Nature-Based Solutions; Post-Conflict Recovery; Sudan; Biodiversity Conservation; Indigenous Knowledge; Health Systems; Sustainable Development.*

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INTRODUCTION

Context: Post-War Sudan's Healthcare and Environmental Challenges

Sudan experiences latitudes 3-23°N with a broad range of climatic zones: arid-semi-arid in the north, middle semi-humid to semi-arid, and arid-humid to equatorial humid in the south. Mean annual rainfall is highly diverse (0-1,400mm), influencing soils and agriculture. They range from humid climates with ferrasols and nitisols to arid environments with poor yermosols. Such environmental diversity is accountable for Sudan's exceptional vegetation variety. According to Wickens (1991), Sudan consists of eight disparate vegetation belts. Sudan supports over 3,156 species, distributed across 1,137 genera and 170 families (Broun and Massey, 1929; Andrews, 1950, 1952, 1956; El Amin, 1990).

Decades of war have widely impacted the population, infrastructure, and natural landscape of Sudan. Being a post-conflict nation, it is faced with the necessity of rebuilding, particularly in areas of health and the environment. The UNDP (2021) notes that war has considerably eroded institutional capacity, left millions displaced, and interrupted access to basic services, notably in the rural and poor regions of the country.

Health infrastructure remains inadequately equipped, under-financed, and over-stretched. Formal care in the majority of settings is unaffordable, and rural communities rely on traditional modes of healing (WHO, 2013). Meanwhile, forests, savannas, and arid lands have experienced conflict-driven displacement, land degradation, and climate stressors (Osman-Elasha, 2009). Such a twin crisis of ecological instability and public health vulnerability requires joint efforts embracing ecosystem restoration with community resilience and healing.

Importance of Indigenous Knowledge and Nature-Based Solutions

Indigenous Knowledge (IK) refers to the accumulated practice, beliefs, and know-how gained by the people at the local level over generations of interaction with their environment. IK is adaptive, holistic, and place-based, sustaining healthy ways of healing, resource use, and conservation of biodiversity (Mazzocchi, 2006). IK significantly contributes to biological, ecological and pharmacological sciences, and forms the basis of traditional and complementary systems of medicine.

Nature-Based Solutions (NBS), as defined by Cohen-Shacham *et al.* (2016), are activities that restore and preserve ecosystems in an effort to address people's problems and benefit both people and nature. In practice, traditional medicine is a fine example of NBS, delivering cheap, locally adapted solutions to health and environmental crises.

Sudanese traditional healers rely mainly on medicinal plants, some of which are found in fragile ecosystems. Preservation of such plants is pivotal for sustaining cultural heritage, biodiversity, and ecosystem services and climate resilience. Uncontrolled harvesting, particularly of wild species such as mahogany and balanites bark, risks the extinction of genetic materials and species. Desertification, overexploitation, and land-use pressures (e.g., Gum Arabic and Senna production) exacerbate plant availability and long-term ecosystem integrity.

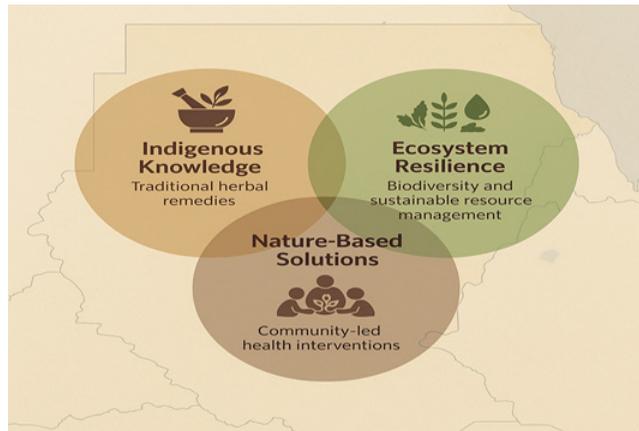


Figure 1: Interconnection of Indigenous Knowledge, Health, and Ecosystem Resilience in Post-Conflict Sudan

Source: Adapted from IUCN and FAO conceptual frameworks

OBJECTIVES AND SIGNIFICANCE OF THE PAPER

This paper responds to the applicability of IK and traditional medicine as an NBS for post-conflict Sudan. It responds to how recovery based on local knowledge can act as mechanisms for human recovery and nature recovery.

The specific objectives of the paper are to:

- illustrate the background and socio-cultural value of traditional medicine in Sudan's healthcare system;
- describe how IK ensures environmental sustainability by conserving wild medicinal plants;
- respond to existing challenges such as legal recognition, scientific validation, and policy integration;
- propose strategy for incorporating IK and indigenous healing practices into Sudan's formal health and environmental frameworks.

The paper forms part of post-conflict rehabilitation discourse that is ecologically aware, culture-sensitive, and community-led. It demonstrates the imperatives for hybrid solutions combining modern science and traditional knowledge with an outlook towards catalysing long-term resilience in Sudan. Traditional knowledge can be used to monitor biodiversity changes over time, providing early warnings of potential threats and informing conservation efforts.

Table 1: Summary of Key Issues in Post-War Sudan and Corresponding Indigenous Knowledge Contributions

Challenge	IK-Based Contribution
Damaged healthcare infrastructure	Traditional medicine offers accessible, community-based care
Loss of biodiversity	Sustainable harvesting of medicinal plants supports conservation
Displacement and cultural erosion	IK strengthens identity, heritage, and coping managing mechanisms
Climate variability and drought	Traditional land and water practices support adaptation

Source: Compiled by the author based on data from WHO (2013), Cohen-Shacham *et al.* (2016), UNDP (2021), Osman-Elasha (2009), and Mazzocchi (2006)

THEORETICAL AND CONCEPTUAL FRAMEWORK

Defining Indigenous Knowledge, Traditional Medicine, and Nature-Based Solutions

Indigenous Knowledge (IK) is locally rooted knowledge developed over generations through interaction with nature, covering areas such as health, agriculture, and environmental stewardship (Grenier, 1998).

Traditional Medicine (TM), a core element of IK, includes culturally-based health practices used to prevent and treat illness (WHO, 2013).

Nature-Based Solutions (NBS) are ecosystem-based approaches to societal challenges that benefit both people and nature (Cohen-Shacham *et al.*, 2016). When traditional medicine uses sustainably harvested plants, it becomes a form of NBS, supporting healthcare while conserving biodiversity.

Interlinkages between Human Health and Ecosystem Restoration

Human health and ecosystem health are intertwined. Ecosystem degradation, whether deforestation, loss of soil, loss of biodiversity, or climatic change, has direct consequences for medicinal resources, clean water, good food, and disease regulation (Reid *et al.*, 2005). Healthy ecosystems, on the other hand, provide critical services that enable physical, mental, and social health.

In rural Sudan, traditional healers rely heavily on wild and semi-domesticated plants acquired from indigenous ecosystems, or other sources using imported medicinal plants that are not indigenous. Therefore, the conservation of such landscapes not only ensures the availability of herbal medicine but also assists in catering to a greater ecological balance that minimises the dissemination of disease vectors and elicits mental well-being through cultural continuity.

Figure 2 illustrates the feedback loop between ecosystem restoration and public health.

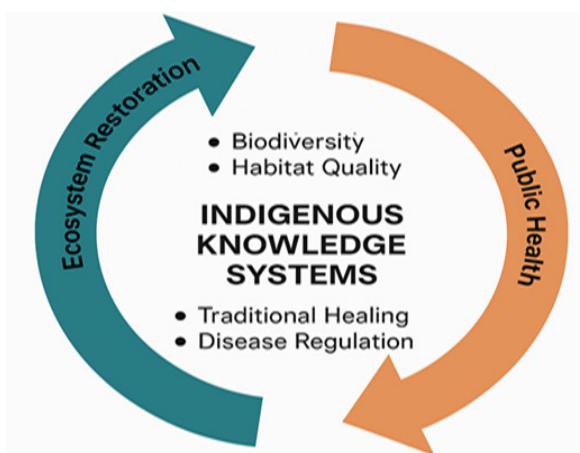


Figure 2: Human-Ecosystem Health Feedback Loop in Indigenous Knowledge Systems

Source: Adapted from Reid *et al.* (2005)

Overview of Ecosystem Services Linked to Medicinal Biodiversity

Biological diversity of micro-organisms, flora and fauna provides extensive benefits for biological, health, and pharmacological sciences. It is also the source of traditional and complementary medicines, and significantly contributes to ecosystem services, notably:

- **Provisioning services:** the supply of raw materials, i.e., medicinal plants, fruits, roots, and oils. Benefit sharing arrangements (BSA) include the following:
 - *Monetary:* up-front payments, salaries, license fees, higher sale price, equity and profit-sharing opportunities.
 - *Non-monetary:* contribution to the local economy and at the village level (e.g., food security, infra-structure, strengthening capacities of local populations in the sustainable use of their natural genetic resources, transfer of technology, training, etc.).
- **Regulating services:** including air and water filtration, disease regulation by biodiversity buffers, and microclimate control.
- **Cultural services:** religious significance of sacred groves, ancestral traditions, and traditional healing ceremonies.
- **Supporting services:** such as nutrient cycling and soil formation that preserve the habitats of medicinal species.



Figure 3: Regulating Rules for Wild Collection

Source: Compiled by authors

Table 2 summarises these services and their relevance to traditional medicine in Sudan.

Table 2: Ecosystem Services Provided by Medicinal Biodiversity

Type of Service	Example from Sudanese Context	Link to Traditional Medicine
Provisioning	Neem (<i>Azadirachta indica</i>) Acacia gum Molita (<i>Sonchus oleraceus</i>)	Used in antiseptics, anti-malarials, anti-rheumatic and skincare Constipation, kidney diseases Malaria
Regulating	Forest and savanna buffers	Reduce disease vectors and maintain air/water quality
Cultural	Sacred sites (e.g., Marahiil forests)	Centres for healing and traditional ceremonies
Supporting	Biodiverse root zones in clay soils	Maintain healthy habitats for medicinal herbs

Source: Compiled by the authors based on data from Reid *et al.* (2005), WHO (2013), Osman-Elasha (2009), Bélanger and Pilling (2019), and Giday *et al.* (2010)

Convention on Biodiversity and Protection of Indigenous Knowledge

Global Framework: The Convention on Biological Diversity (CBD)

Adopted at the 1992 Rio Earth Summit, the CBD is a global agreement focused on conserving biodiversity, sustainable use of its components, and fair benefit-sharing from genetic resources. Article 8(j) recognises the role of IK in biodiversity conservation, while Article 8(k) addresses the protection of threatened species. Article 15 affirms national sovereignty over genetic resources and mandates access based on prior informed consent and mutually agreed terms (CBD, 1992).

The CBD marks a shift in global environmental governance, valuing not only scientific knowledge but also IK systems. It encourages the integration of traditional knowledge into national biodiversity strategies, with emphasis on community rights and benefit-sharing, whether through royalties, capacity-building, or co-developed research.

Application in the Sudanese Context

Environment and health concerns in post-conflict Sudan closely coincide with the aims of the Convention. Indigenous people in places such as South Kordofan, Darfur, and the Blue Nile have acquired significant local experience in medicinal plants for treatment of different ailments and conservation methods. Local knowledge such as this has hardly any formal protection or legal standing.

The current Sudan policy environment still does not fully embrace Article 8(j) or the Nagoya Protocol, a supporting agreement to the CBD that regulates Access and Benefit-Sharing (ABS). Such absence leaves traditional knowledge vulnerable to misappropriation, exploitation, and loss due to inadequate documentation and lack of effective institutional arrangements (El Dirani and El Sammani, 2020).

Importance of Access and Benefit-Sharing (ABS)

The Nagoya Protocol of 2010 promotes fair and equitable sharing of benefits derived from the use of genetic resources and traditional knowledge. It provides for communities to benefit in financial, educational, or capacity-building, when their knowledge or biological resources are used (Morgera *et al.*, 2013).

ABS governs access to genetic resources and benefit sharing derived therefrom among providers (e.g., indigenous peoples) and users (e.g., corporations, researchers). Article 8 resolves contentious matters for non-commercial research, which can later assume commercial objectives.

Implementation of ABS in Sudan can:

- protect the rights of communities;
- improve medicinal plant conservation;
- promote research partnerships between local healers, universities, and overseas institutions.

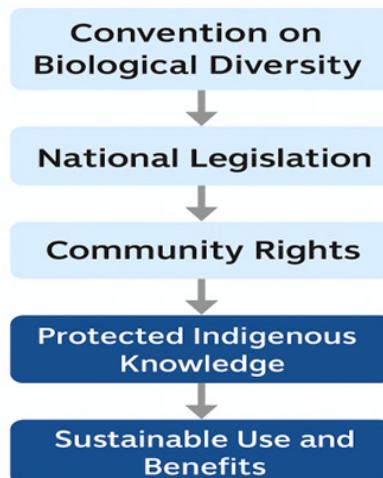


Figure 4: Policy Pathway from CBD to Local Protection of Indigenous Knowledge

Source: Adapted from SCBD, 2020

Challenges and Opportunities

Sudan's key challenges include:

- a lack of national ABS frameworks;
- weak enforcement mechanisms for intellectual property rights over traditional medicine – paragraph 19 of the Doha Declaration;
- limited dialogue between government institutions and indigenous communities.

However, Sudan also has unique opportunities. Its diverse ethnobotanical heritage, growing academic interest, and emerging national environmental policy reforms provide a strong foundation for integrating CBD and ABS principles into law and practice. Collaborative mapping, community

protocols, and ethnobotanical databases could support this transition, ensuring both biodiversity conservation and community empowerment.

HISTORICAL AND CULTURAL FOUNDATIONS

Evolution and Role of Traditional Medicine in Sudanese Communities

Sudanese traditional medicine is a centuries-old system rooted in cultural and ecological heritage, combining Arab-Islamic and sub-Saharan African practices (Al Safi, 2006). It remains the primary healthcare source, especially in areas lacking modern services. In Darfur and Kordofan, over 70% still use it for treating diseases such as malaria and skin disorders (Ahmed and Adam, 2018). A survey in Omdurman confirmed continued reliance on traditional healing (Table 3).

Table 3: Survey for Traditional Healers in Omdurman

State/Area	Year	Herbalists	Zār Sheikhas	Bone Setters	Faki Sheikhs	Total
Thora & Karari	1998	35	28	37	42	142
Ombada	2000	12	30	48	64	154
Hag Yousif	2004	14	18	65	87	184
Alazahri / اءايلوؤ لبج	2007	7	8	32	33	80
Khartoum North	2008	5	9	46	42	102

Source: Based on data extracted from a survey conducted by the Medicinal and Aromatic Plants & Traditional Medicine Institute, which examined the reliance on traditional medicine in Omdurman

Cultural Significance and Transmission of Indigenous Healing Knowledge

Indigenous healing is a cultural practice and a form of health based on spiritual and ecological interdependence (WHO, 2013; Boddy, 1989). It is communicated orally from elder to apprentice through practice and observation. However, conflict, migration, and contemporary education are disrupting this transmission and endangering traditional knowledge (Abdelgadir and Ahmed, 2017).

Key Actors: Traditional Healers, Elders, and Community Custodians

Traditional medicine in Sudan is sustained by key community figures:

- **Traditional Healers (Hakims, Dayas, Fakis):** Respected for their spiritual and herbal knowledge, they offer remedies using plants such as harjal, neem, and sidir; they also perform healing rituals.
- **Elders:** Keepers of oral tradition, they mentor younger healers and uphold healing practices and norms.
- **Community Custodians (Sheikhs, tribal leaders, women's groups):** They facilitate healing events, protect sacred sites, and help preserve ecological and cultural knowledge.

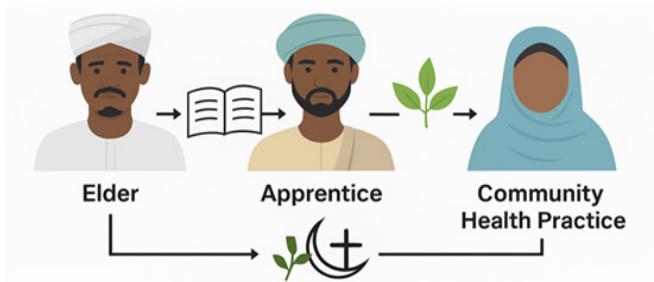


Figure 5: Knowledge Transmission Pathways in Sudanese Traditional Medicine

Source: Adapted from Bélanger and Pilling (2019) and WHO regional ethnomedicine reports

THE ROLE OF INDIGENOUS KNOWLEDGE IN HEALTHCARE

Contributions to Primary Healthcare, Especially in Rural Areas

Traditional knowledge, especially traditional medicine, remains an important part of primary healthcare delivery in Sudan, more so in conflict and rural areas. Due to inadequate access to formal health care, traditional practitioners such as hakims, dayas, and fakis are often the first and only providers (WHO, 2013; Ahmed and Adam, 2018). In North Darfur, up to 80% of its population utilises traditional medicine for common ailments (Abdelgadir and Ahmed, 2017). Its deep religious and cultural roots make it accessible and widely acceptable.

Examples of Herbal Remedies and Their Uses

Sudan's ecological diversity provides a rich pharmacopeia of medicinal plants used in traditional healing. These remedies are derived mostly from roots, barks, leaves, flowers and seeds, and are often applied in the form of infusions, decoctions, pastes, or fumigation.

Table 4 highlights some common Sudanese medicinal plants and their traditional uses.

Table 4: Selected Herbal Remedies in Sudanese Traditional Medicine

Name of Plant	Local Name	Part Used	Traditional use
<i>Acacia nilotica</i> *	<i>Algarad</i>	Fruits	Fumigation for colds
<i>Acacia senegal</i>	<i>Samg Alhashab</i>	Exudate	Laxative & Kidney Diseases
<i>Acacia seyal</i> *	<i>Samg Altalih</i>	Exudate & Wood	Wounds & Fumigation
<i>Adansonia digitata</i> *	<i>Altibaldi</i>	Fruit bulb	Diarrhoea & Abdominal pain
<i>Aloe sankitana</i> *	<i>Alsabar</i>	Leaf juice	Wounds
<i>Azadirachta indica</i> *	<i>Alneem</i>	Fruits & leaves	Insecticide
<i>Balanites aegyptiaca</i>	<i>Al Higleeg or Lalob</i>	Fruit kernel	Laxative & Jaundice
<i>Boswellia papyrifera</i>	<i>Al luban</i>	Exudate	Colds, Expectorant
<i>Cuminum cyminum</i>	<i>Al Shmar</i>	Fruits	Carminative

Name of Plant	Local Name	Part Used	Traditional use
<i>Cassia acutifolia</i>	<i>Al Senna makah</i>	Fruits & Pods	Laxative
<i>Citrullus colocynthis</i> *	<i>Al Handal</i>	Fruits & Seeds	Laxative, Anti-rheumatic
<i>Cymbopogon proximus</i> *	<i>Al Mahareb</i>	Leaves	Urinary tract infection
<i>Hibiscus sabdariffa</i>	<i>Al Karkadeh</i>	Flower	Antihypertensive
<i>Hyphaene thebachia</i> *	<i>Al Doum</i>	Fruits	Antihypertensive
<i>Haplophyllum tuberculatum</i>	<i>Al Haza</i>	Aerial Parts	Abdominal Pain
<i>Grewia tenax</i>	<i>Al Godeim</i>	Fruits	Hematinic
<i>Lawsonia inermis</i>	<i>Al Henna</i>	Leaves	Dye
<i>Ocimum basilicum</i> ** <i>Ocimum sancticum</i>	<i>Al Rehan</i>	Whole Plant	Insecticide
<i>Phoenix dactylifera</i>	<i>Al Balah, Al Tamur</i>	Fruits	Laxative
<i>Salvadora persica</i>	<i>Al Muswak</i>	Stems	Muswak
<i>Solenostemma argel</i>	<i>Alhargal</i>	Leaves	Antispasmodic
<i>Ricinus communis</i> **	<i>Al Kherwia</i>	Seeds	Drastic laxative
<i>Tamarindus indica</i>	<i>Al Aradeb</i>	Fruit bulb	Laxative & antimalarial
<i>Terminalia brownii</i> Fresen		Wood	Fumigation
<i>Waltheria indica</i> *		Roots	

Source: Adapted from data on selected herbal remedies commonly used in Sudanese traditional medicine, as compiled by the Medicinal and Aromatic Plants & Traditional Medicine Institute and relevant ethnobotanical literature

Benefits: Affordability, Accessibility, and Cultural Acceptance

The greatest advantage of conventional health systems is that they are cheap. Conventional medicine consists primarily of drugs within the immediate environment, involving zero or little money exchange. This makes them extremely useful to poor communities at a time of post-war economic devastation (Al Safi, 2006).

The systems are also:

- **Accessible:** practitioners are locally based, and there are herbs everywhere in the surrounding environment;
- **Culturally appropriate:** healing rituals are consistent with local assumptions about health, illness, and spirituality;
- **Supplementing biomedical care:** traditional medicine supplements biomedical care, as in diverse health systems.

These practices also confirm community participation in health and preserve cultural identity in an internationalised and displaced society (Figure 6).

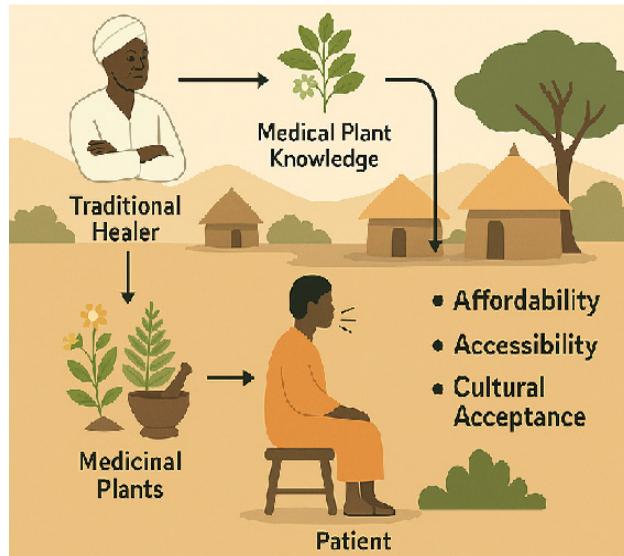


Figure 6: Indigenous Knowledge Contributions to Healthcare in Rural Sudan

Source: Adapted from WHO and Traditional Medicine Strategy (2013)

BIODIVERSITY AND ENVIRONMENTAL STEWARDSHIP

Inventory of Key Medicinal Plants in Sudan and Their Ecological Roles

Sudan has diverse ecosystems ranging from desert to savannah woodland and temporary wetlands, each with an abundant diversity of medicinal plants traditionally used in medicine. These plants are of importance ecologically as a food source for pollinators, erosion agents, and nutrient cycling agents. From time immemorial, these species have been relied upon by native populations not only for health but also for subsistence, spiritual purposes, and ecological functions.

Table 5 shows an inventory of key medicinal plants found in different regions of Sudan.

Table 5: Key Medicinal Plants in Sudan and Their Ecological Significance

Scientific Name	Local Name	Traditional Use	Ecological Role
<i>Acacia nilotica</i>	<i>Sunt</i>	Antibacterial, dental care	Soil stabilisation, fodder, shade
<i>Balanites aegyptiaca</i>	<i>Heglig</i>	Liver health, laxative	Drought-tolerant species, windbreak
<i>Boswellia papyrifera</i>	<i>Luban</i>	Anti-inflammatory, incense	Resin production, carbon sequestration
<i>Combretum hartmannianum</i>	<i>Ahabil</i>	Wound healing, respiratory ailments	Biodiversity support in savannah ecosystems
<i>Ziziphus spina-christi</i>	<i>Sidir</i>	Skin infections, spiritual protection	Pollinator support, reforestation efforts

Source: Compiled from Neffati *et al.* (2008); Abdelgadir and Ahmed (2017); Al Safi (2006)

Conservation of Habitats through Sustainable Harvesting Practices

Indigenous communities have developed sustainable harvesting practices to preserve medicinal plant resources and the ecosystems that support them. These include:

- rotational harvesting to allow for regrowth;
- selective picking of specific parts of a plant (e.g., bark or leaves) without damaging the entire plant;
- harvesting within sacred groves or spiritually conserved areas where picking is restricted.

These practices are themselves old systems of conservation, preserving plant diversity and ecosystem integrity overall (Berkes, 2012). For some Sudanese communities, knowledge of how much, when, and where to harvest is transmitted between generations, such that resources do not get depleted and ecosystems are not destroyed.

In post-war Sudan, mapping and codifying these practices could assist in making ecosystem restoration in communities more successful.

Threats: Overharvesting, Land Degradation, and Climate Impacts

Despite their cultural and natural importance, Sudan's medicinal plants are under extreme threat:

- **Overexploitation:** Widespread uncontrolled collection, especially in times of war, exposes species to overuse has of bark, roots, and entire plants (Bélanger and Pilling, 2019).
- **Land Degradation:** Agricultural expansion, deforestation, and urbanisation are degrading habitats, particularly in the forest reserves of Blue Nile and South Kordofan.
- **Climate Change:** Unpredictable rain, drought, and raised temperatures are reducing plant survival, seriously impacting regions such as Northern Kordofan (Osman-Elasha, 2009).

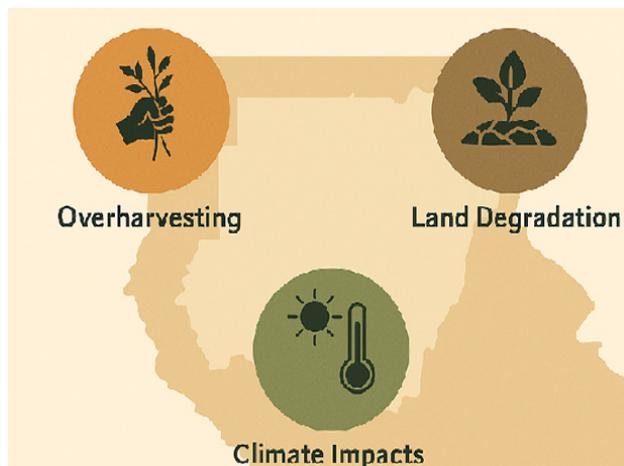


Figure 7: Pressures on Medicinal Plant Biodiversity in Sudan

Source: Adapted from Bélanger and Pilling (2019) and Reid *et al.* (2005)

CHALLENGES TO INTEGRATION

Despite its cultural value and practical utility, IK, particularly in traditional medicine, faces several challenges to its incorporation into Sudan's official healthcare and environmental policy framework. These are of structural, institutional, and epistemological origin.

Shortfalls in Regulation, Quality, Safety, and Scientific Validation

Sudanese traditional medicine lacks regulation, with no standardised systems to ensure quality, dosage, or safety (WHO, 2013; Al Safi, 2006). Most remedies are based on inherited knowledge without clinical validation. Unlike countries such as China, India, or recently Burkina Faso, Sudan has no formal integration of traditional healers into the national health system (Abdalla, 2018). This gap poses risks such as:

- toxicity from improper preparation;
- inaccurate dosing;
- delays in seeking critical medical care.

Without quality control, even effective traditional medicine risks losing public trust.

Weak Institutional Frameworks and Policy Recognition

Sudan lacks a clear institutional framework for managing traditional knowledge, especially regarding:

- intellectual property rights (IPR);
- access and benefit-sharing (ABS);
- integration into health education.

Traditional knowledge is rarely addressed in national health and environmental policies (El Dirani and El Sammani, 2020), leaving practitioners legally unrecognised and unsupported. Fragmented governance across key ministries further hinders policy co-ordination and the integration of IK into formal systems.

Fragmented Data and Lack of Documentation

Another key obstacle is the absence of systematic documentation and databases on traditional healing practice, medicinal plant uses, and treatment outcomes. The majority is oral in nature, passed from seniors to apprentices. Conflicts, displacement, and modernisation hang over this precarious mode of preservation (Osman-Elasha, 2009). Without dependable information:

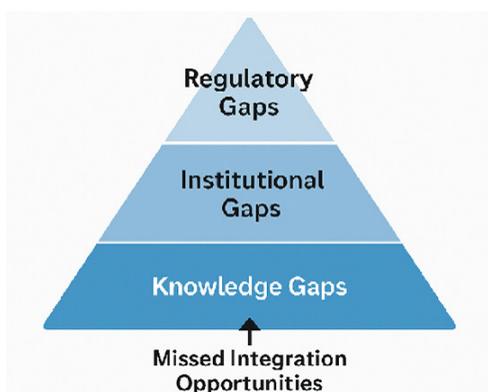
- researchers cannot analyse or reproduce remedies;
- policy-makers are unable to plan or legislate;
- future generations will lose important knowledge.

Table 5 summarises the major institutional and systemic gaps.

Table 6: Barriers to Integration of Indigenous Knowledge in Sudan

Category	Challenges
Regulatory	Lack of national standards for safety and efficacy of herbal medicine
Institutional	No government body dedicated to IK governance
Legal/Policy	No protection for IPR or access-benefit sharing mechanisms
Educational	Absence from medical curricula and research funding
Knowledge Systems	Oral transmission, undocumented practices, data fragmentation

Source: Compiled from WHO (2013), Al Safi (2006), El Dirani and El Sammani (2020)

**Figure 8: c Challenges to Integrating Indigenous Knowledge**

Source: Created by the authors based on data from WHO (2013), Al Safi (2006), El Dirani and El Sammani (2020), and Osman-Elasha (2009)

POLICY, LEGAL, AND INSTITUTIONAL LANDSCAPE

The admission of IK into Sudan's post-conflict environmental and health networks requires an upgraded and integrated policy, legal, and institutional framework. Sudan's current governance systems do not adequately value or realise IK's potential, specifically in traditional medicine and ecosystem management areas. This section provides the national outlook, compares regional strategy, outlines lost opportunities, and outlines a strategic policy framework.

Sudanese Health and Environmental Policy Overview

Sudan's National Health Policy acknowledges traditional medicine but lacks clear plans for its integration, regulation, or funding. There are no licensing systems, standards, or formal networks for traditional practitioners, who mostly operate informally (Abdalla, 2018).

On the environmental front, while Sudan is a signatory to the Environmental Protection Act (2001) and has a National Biodiversity Strategy and Action Plan (NBSAP 2015-2020), these frameworks mention community involvement but offer no legal or financial measures to support IK in environmental governance (El Dirani and El Sammani, 2020).

International Treaties and Guidelines on Traditional Knowledge

Sudan is a party to significant global treaties that obligate IK:

- **CBD (1992):** Article 8(j) promotes conservation of customary biodiversity knowledge.
- **Nagoya Protocol (2010):** Promotes fair benefit-sharing from the use of genetic resources and related IK.
- **Doha Declaration (2001):** Affirms developing countries' pledge on public health sovereignty under the WHO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (WTO, 2001).
- **United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (2007):** Respects indigenous peoples' rights regarding their knowledge, resources, and free, prior, and informed consent.

These guarantees notwithstanding, Sudan has no national law to apply them or safeguard IK from misappropriation, loss, or biopiracy.

Comparative Policy Landscape

To gain a greater appreciation of Sudan's potential and shortcomings, it is illuminating to compare them with others that have further developed along the IK integration process:

Table 7 shows that while Sudan shares regional challenges, countries such as India and South Africa offer models for policy integration, data protection, and legal innovation.

Table 7: Comparative Overview of Indigenous Knowledge Integration in Selected Countries

Country	Legal Protection of IK	Integration in Health Policy	Access & Benefit Sharing (ABS)	Community Databases
Sudan	Weak	Informal	Not operational	Limited/Oral
South Africa	Strong (IP laws)	Partially integrated	Active ABS frameworks	Yes
India	Strong (AYUSH Ministry)	Fully integrated (dual systems)	Functional ABS system	Yes (TKDL)
Ethiopia	Moderate	Limited integration	Developing frameworks	Emerging

Source: Compiled from WHO (2013), UNDP (2021), and national policy documents

Case Insight: A Missed Opportunity in Sudan's COVID-19 Response

The response in Sudan was largely biomedical. The traditional medicine systems that for decades had provided community-based care during outbreaks were not considered when planning the response.

In contrast, Madagascar officially promoted herbal remedies (COVID-Organics) using traditional plants and supported with local studies. The following is an example of how Sudan

missed the opportunity to leverage its indigenous health system for scale-up coverage, community training, and improved care, especially at rural levels.

Policy Harmonisation and Protection of Indigenous Rights Opportunities

Post-war recovery presents a critical opportunity to integrate IK into Sudan's health and environmental sectors through strategic reforms (Figure 9):

1. Legal Codification

- Enact a National Traditional Knowledge Act aligned with the Nagoya Protocol
- Include IPR protections, community benefit-sharing, and knowledge registries

2. Institutional Co-Ordination

- Form an inter-ministerial task force (Health, Environment, Culture)
- Involve tribal leaders, civil society, and universities

3. Community-Led Knowledge Systems

- Develop community protocols and ethnobotanical databases
- Promote local documentation and digitisation of medicinal knowledge

4. Curriculum and Research Integration

- Introduce traditional medicine modules in health education
- Encourage collaborative research between scientists and traditional healers

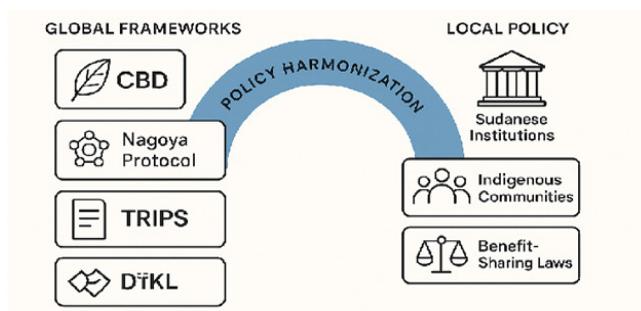


Figure 9: Bridging Global Frameworks and Local Policy for Indigenous Knowledge Protection

Source: Adapted from SCBD (2020) and UNDP (2021)

CASE STUDIES AND FIELD INSIGHTS

To better understand the applied purpose of IK as an NBS in Sudan, this section presents field-based case studies from within the country in addition to comparative findings from other ecologically fragile or post-conflict countries. Through these cases, it is shown how practices that have a grassroots existence are not only employed for survival and healing but also biodiversity preservation, resilience, and regeneration of the ecosystem.

Sustainable Traditional Medicine Practices in Sudanese Communities

Local healing systems are the basis of healthcare at the community level in Sudan's rural sectors, most notably in South Kordofan, Blue Nile State, and Darfur. Healers are highly respected individuals who provide treatment for everything from malaria and infection to reproductive services and mental health from localised botanical knowledge.

Example: Abu Jubeiha District, South Kordofan

Ahmed and Adam (2018) researched the way traditional healers in this region utilised species such as *Boswellia papyrifera* (frankincense) and *Combretum hartmannianum* (Abahi tree) in wound healing and respiratory disease. There are strict rules imposed by healers on seasonal picking and community restrictions on overuse for sustainability and permanence. The key practices identified include:

- rotational seasons of harvest;
- healer-led community education;
- spiritual taboos as conservation principles (sacred trees).

Such customary practices keep plant populations under control, enhance intergenerational knowledge, and establish cultural continuity, especially important in war-affected communities.

Comparative Practices from Similar Post-Conflict Contexts

Countries emerging from conflict have successfully integrated IK into national rebuilding efforts.

Rwanda

Post-genocide Rwanda adopted a dual healthcare system, registering traditional healers and promoting medicinal plant cultivation (e.g., *Artemisia afra*) in state-supported gardens (WHO, 2013).

Ethiopia

In Oromia and Tigray, local councils manage ethnobotanical reserves with harvest regulations and zoning incorporated into national biodiversity strategies (Neffati *et al.*, 2008).

Mozambique

After civil war, traditional healers led trauma healing through ceremonies that also supported ecosystem restoration, especially in sacred forests.

Table 8: Comparative Overview of IK Practices in Post-Conflict Contexts

Country	Practice	Impact
Sudan	Healer-led conservation, sacred plants	Health access + local biodiversity protection
Rwanda	Licensed herbalists, medicinal gardens	Dual healthcare system + herb trade
Ethiopia	Ethnobotanical zoning, reserve councils	Species conservation + legal enforcement
Mozambique	Healing rituals in sacred forests	Cultural revival + ecosystem restoration

Source: Adapted from WHO (2013), Neffati *et al.* (2008), and Ahmed and Adam (2018)

Community-Driven Biodiversity Protection Initiatives

In certain areas of Sudan, elders and traditional healers are de facto custodians of ecosystems locally. They have traditional knowledge that includes:

- location of high-value medicinal species;
- seasonal variations affecting potency;
- the spiritual role of forest and riverine ecosystems to community health.

These communities use oral agreements, clan rules, and religious prohibitions to prevent both deforestation and over-harvesting.

Example: Al-Sunut Forest, Khartoum

Although located on an urban edge, Al-Sunut Forest remains a revered site by the community for spiritual healing and the collection of medicinal plants. The community leaders collaborate with students and NGOs to identify, tag, and document endangered medicinal plants (Al Safi, 2006).

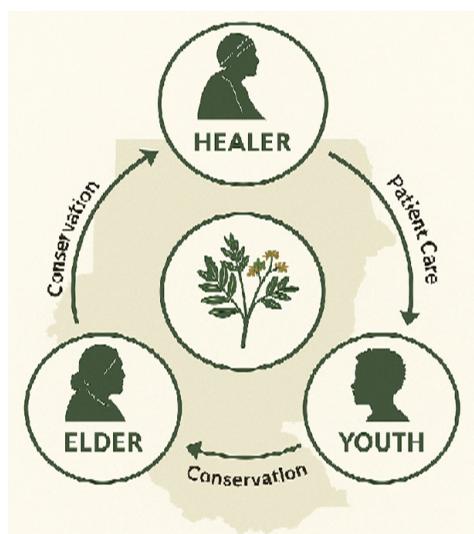


Figure 10: Community Roles in Biodiversity and Health Stewardship

Source: Based on WHO and FAO community stewardship models

STRATEGIC PATHWAYS FOR INTEGRATION

In order to utilise IK as an efficient, sustainable, and equitable NBS for Sudan after conflict, recognition would have to shift to integration in institutions. This will have to be followed by analysis of data, rewriting of policy, institutional co-ordination, and community involvement. Briefly described below are five inter-related strategic pathways for IK mainstreaming into Sudan's national environment and health sectors.

Analyse and Disseminate Biodiversity-Health Linkages

One place to begin is by conducting a systematic investigation of the ways in which biodiversity sustains traditional medicine and how that sustains community health. Ethnobotanical surveys, community-biodiversity maps, and pharmacology research must be carried out to:

- identify species of utmost significance and their ecological niches;
- quantify ecosystem services from medicinal plants;
- locate the dependence of communities on herbal medicines.

Dissemination of such information, through open-access platforms, community workshops, and public-university collaboration, will improve evidence-based policy-making knowledge bases (Neffati *et al.*, 2008; WHO, 2013).

Improve Access to Policy-Level Information on Biodiversity and Genetic Resources

Despite Sudan's signature on international commitments such as the Nagoya Protocol, there is limited awareness among stakeholders, most importantly traditional practitioners, regarding rights and obligations on:

- access and benefit-sharing (ABS);
- protecting genetic resources;
- intellectual property regimes.

It is important to develop policy briefs, multilingual manuals, and national workshops in order to improve awareness among ministries, universities, and communities (SCBD, 2020).

Mainstreaming Indigenous Knowledge into National Health and Environmental Planning

Indigenous knowledge (IK) must move from the margins to the core of Sudan's recovery. Key steps include:

- integrating traditional medicine into national health and basic service plans;
- embedding community-based conservation in biodiversity strategies (e.g., NBSAP updates);
- recognising traditional healers and elders as key ecosystem knowledge holders in restoration efforts.

Set Up Cross-Sectoral Collaboration

Successful integration requires multi-ministerial co-ordination between the:

- Ministry of Health (public and community health);
- Ministry of Environment (climate resilience and conservation);
- Ministry of Higher Education and Culture (research, documentation, cultural heritage).

Civil society organisations, universities, youth groups, and local councils must also be empowered since they work at the intersection of culture, biodiversity, and public health (El Dirani and El Sammani, 2020).

Key Recommendations (Table 9 and Figure 11)

Table 9: Summary of Strategic Recommendations for Integrating Indigenous Knowledge

Strategic Area	Recommended Action
Research	Ethnobotanical inventories, herbal efficacy trials, IK-conservation linkages
Capacity Building	Training programmes for healers, health workers, and local policy-makers
Policy Reform	Enactment of national IK protection laws and implementation of Nagoya Protocol
Benefit Sharing	Community contracts, ABS frameworks, financial support to plant custodians
Documentation	Digitised IK databases, oral history archives, national ethnomedicine registry

Source: Compiled by the author based on data and policy recommendations from WHO (2013), SCBD (2020), El Dirani and El Sammani (2020), and Neffati *et al.* (2008)

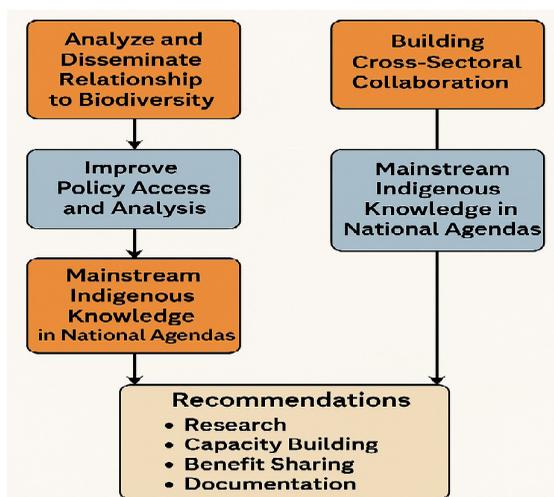


Figure 11: Strategic Pathways to Integrate Indigenous Knowledge into Policy and Practice

Source: Adapted from WHO (2013) and SCBD (2020)

CONCLUSIONS

Sudan's reconstruction after the war requires more than infrastructure; it also requires healing that runs deep into communities, cultures, and nature. We have shown from this paper how IK, through traditional medicine, is a robust and suitable NBS that is able to sustain human well-being and recover biodiversity.

Strategic Vision: Healing People, Healing the Land

Sudan's IK is no history relic; it is a working, adaptive, locally-governed system that has balanced the public health, climate change adaptation, and biodiversity conservation goals. As this paper demonstrates, it is:

- scientifically valid;
- culturally meaningful;
- economically sound;
- environmentally restorative.

The legal protection and development of such knowledge, institutions, and human beings could possibly redirect Sudan's post-conflict reconstruction to a people-centred and nature-positive transformation.

Rooted in Resilience: A Call for Indigenous Knowledge in Sudan's Recovery

Sudan's path to healing is through an appreciation of IK as a dynamic system of sustenance and care rather than as tradition. Healing individuals and ecosystems requires:

- law and policy recognition of IK in health and environmental planning;
- empowering local custodians as co-owners of knowledge and biodiversity;
- integrating IK into education, public health, and conservation plans;
- long-term financing of research, training, and documentation;
- ministerial, academic, traditional healer, and international partnership collaboration.

By developing IK, Sudan will be empowered to redevelop from within, reclaiming dignity, ecosystems, and a future founded on its own heritage and natural knowledge.

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BIOGRAPHY



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