Sacred Groves and Indigenous Knowledge as Natural Models of Decentralised Data Security

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Abstract

The rapid digitalisation of ethnobotanical and ecological knowledge has created significant challenges related to data security, ownership, and ethical access, particularly for Indigenous Knowledge. Sacred groves are traditionally protected forest patches conserved through indigenous belief systems and community-based governance. In addition to enhancing the conversation about knowledge governance, understanding sacred groves as real examples of decentralised security provides culturally relevant ideas for creating solid, moral, and community-focused data security frameworks in the digital era. This study conceptualises sacred groves as natural analogues of decentralised data security systems. These socio-ecological systems operate without centralised authority, relying instead on decentralised decision-making, customary laws, and collective accountability to ensure long-term protection of biological and cultural resources. Another well-known ecological example of these systems is seen in sacred groves, which serve as protected areas where customs rather than centralised authority control entry, use, and information transfer. By connecting ecology and ethnobotany with new viewpoints on decentralised data security and indigenous data ownership of data, the review promotes multidisciplinary discussion. This review paper explores sacred groves and Indigenous knowledge of a particular area as natural models of decentralised data security.

Keywords: *Sacred Groves, Indigenous Knowledge, Decentralisation, Data Security, Ethnobotany, Biopiracy*

1. Introduction

Sacred groves are community-protected forest patches preserved through indigenous belief systems, cultural taboos, and traditional ecological knowledge. According to this research, sacred groves are socio-ecological analogues of contemporary decentralised datasecurity systems like blockchain. The study analyses concepts like distributed authority, consensus-based trust, norm immutability, and resilience without centralised control, drawing on ethnobotanical literature and decentralised systems research. Sacred groves are forest patches controlled by various communities to conserve biodiversity, medicinal plants, and cultural memory,while decentralised digital systems use cryptographic integrity and peer-to-peer validation to secure data. Sacred groves are forest habitats that are protected by indigenous customs and spiritual beliefs rather than by government enforcement in several regions of India and around the world. (Singh, et al., 2019)According to ethnobotanical studies, sacred groves serve as reservoirs of biodiversity, medicinal plants, and ancestral cultural knowledge. (Raj, Bindu, & Rajkiran, 2025)These groves act as in situ conservation areas,preserving the natural balance and protecting endangered species,as exploitation is limited by rules and rituals. (Eduard, 2023)At the same time, modern information technology has advanced decentralised architectures—especially blockchain—to safeguard digital assets independently of a singular authority. Blockchain disperses records over networks, ensuring communal verification and immutable storage of data. By removing single points of failure, decentralised systems improve availability, privacy, and integrity. Indigenous Knowledge Systems function without a centralised authority, depending instead on trust, cultural regulation, and group decision-making. Selective sharing of indigenous knowledge about therapeutic plants, rituals, and ecological management is frequently confined by ancestry, position, or community approval. This is similar to decentralised security data systems, in which confidence is dispersed among nodes rather than centralised in a single authority. (Ostrom, 1990; Berkes, 2012). Sacred groves exist as in situ conservation sites with strictly regulated access, extraction, and information sharing. It is possible to conceptually map these groves onto protected digital data zones, where sensitive material is protected by access control, authentication, and encryption. Protected digital zones prevent data exploitation and biopiracy, much

as sacred groves avoid ecological degradation. (Gadgil & Vartak, 1976; Posey, 1999). Sacred groves function as micro-reserves preserving endangered flora and fauna and maintaining ecological balance. (Rathore,2024). Deeply ingrained in biocultural resilience, these traditional systems provide important insights for creating culturally sensitive data sovereignty frameworks, especially for Indigenous data.

2. Sacred Groves as Ecological Security Zones

Among the most persistent evidence of native conservation methods are sacred groves. Compared with the surrounding landscapes, these groves often exhibit greater species richness and the preservation of rare medicinal plants. Sacred groves serve as ecological security zones from a data security perspective. Community consensus acts as a validation system, and entry limits operate in combination with authentication methods.Cultural and spiritual sanctions act as deterrents against misuse, reinforcing compliance.

3. Research Hypothesis

H_0 (Null Hypothesis): Sacred groves function solely as cultural-ecological entities and do not provide structural parallels to decentralised information-security systems.

H_1 (Alternative Hypothesis): Sacred groves embody governance principles analogous to decentralised data-security models, including distributed authority, consensus-based regulation, and resilience without centralised enforcement.

4. Indigenous Knowledge Systems as Distributed Knowledge Networks

Rather than being preserved in written records, indigenous ecological knowledge found in holy groves is passed down collectively and is preserved by ritual experts, elders, and community consensus. This distributed custodianship mirrors decentralised information storage, where knowledge persists across many holders rather than a single authority. Knowledge governance should prioritise community benefit, accountability, and ethical stewardship over extractive data models, according to research on Indigenous Data Sovereignty.

5. Challenges to Traditional Decentralised Systems

Despite their resilience, sacred groves face pressures from industrialisation, agricultural expansion, and cultural transformation.

Modern environmental change and land-use shifts threaten ecosystem services and traditional stewardship systems.

Sacred Groves ↔ Blockchain: Conceptual Model Diagrams

Sacred Grove Governance	Digital Decentralised Security
Community-based protection	Peer-to-peer validation
Cultural taboos enforce rules.	Cryptographic protocols enforce rules.
Knowledge transmitted orally	Data stored in a distributed ledger
No single authority controls the grove.	No central server controls the network.
Collective monitoring prevents misuse.	Consensus mechanisms validate transactions.
Long-term ecological memory	Immutable data records

6. Conclusion

Indigenous knowledge systems show that security is not only a technical barrier but also a social process. Modern digital systems can become more secure, transparent, and sustainable by switching from "fortress" security to "ecosystem" security. Sacred groves represent more than cultural relics; they are living examples of decentralised governance that integrate ecological conservation, ethical stewardship, and the preservation of distributed knowledge. By combining ethnobotanical ethics with cryptographic principles, sacred groves serve as a compelling model and practical guide for contemporary data security systems.Their long-term survival demonstrates that security—whether ecological or digital—can emerge from community consensus rather than centralised enforcement. Understanding these systems offers valuable insights for designing resilient, ethical, and sustainable data infrastructures in the digital age.

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