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Deemed Forest of Rajasthan: A potential heritage resource as a mitigation for climate change.

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Abstract:

Deemed forest, recently upgraded terminology for sacred groves, is just a new catch word. Rajasthan's sacred groves are widely acknowledged as important carbon sinks that contribute to mitigating climate change, particularly for the state's arid and semi-arid ecology. However, precise, current carbon sequestration values (in tonnes per hectare or similar) for Rajasthan's sacred groves are not publicly available as of mid-2025. Official mapping and scientific assessment of these groves, now mandated by the Supreme Court, is expected to provide concrete data in the near future.

Key words: Sacred groves, deemed forest, carbon sequestration, climate change.

1. Introduction:

Savred groves has been very ancient and widespread institution in the Old World cultures. As defined by Kosambi (1962) the institution in India is very ancient and dates back to the pre-agrarian hunting-gathering stage, before humans had settled down to raise livestock or till the land. Hughes and Chandran, 1998 defined them as segments 'of landscape, containing vegetation and other forms of life and geographical features that are delimited and protected by human societies under the belief that to keep them in a relatively undisturbed state is expressive of an important relationship of humans with the divine or with nature.

While India's sacred groves in total occupy an estimated 33,000 hectares across the country which is just 0.01 percent of total land country's land area (Gokhale et al. (1998), specific hectare-wise or per-area carbon stock data for Rajasthan's groves are not well reported except a few by (Singh, 2014, Amirthalingam, 2016, Rathore, 2024). Sacred groves has been fairly well studied in India from anthropologicaI as well as biological conservation points of view (for an overview of anthropological studies, see Roy Burman, 1995; Gupta, 1998; Malhotra, 1998; Das and Malhotra, 1998; and for biological conservation related studies see Chandrashekara & Sankar, 1998; Deb et al. 1997; Deshmukh et al., 1998; Pushpangadan et al., 1998; Gokhale et al., 1998; Ramakrishnan, 1998; and also see Ramakrishnan et al. (eds.), 1998.

The natural vegetation cover of sacred grooves is an important component used by nature to regulate global and local climate, hence reducing the impact of climate change at its local context and giving its input in reduction to global warming. Carbon sequestration and oxygen production are the finest and

easiest strategies to ameliorate climate change. Sacred groves represents biodiversity hotspots, refuge for endangered species, they are important for implementation of article 8(j) of the Conservation of Biological Diversity, which stresses the use of traditional wisdom and practices for conservation and sustainable use of biodiversity (Myers et al. 2000). The sacred grove system promotes ecosystem sustainability, plays essential role in carbon sequestration and functions effectively as climate change regulator. Thus, increase in carbon sequestration can be achieved through conservation and effective management of groves.

2. Materials and Methods:

The research documented here submits a documentation transformation of its original status to legal status. Here we will also discuss, the course of journey of Rajasthan's sacred groves to Deemed Forest which has gained the unidentified attention, community pressure and above all a PIL, which smoothened its way. It mentions the challenges encountered in the process. The paper is an attempt to estimate the carbon sequestration of Rajasthan's scared groves, which are playing a key role in conservation of cultural practices parallel to withstand fast growing climate change.

3. Results and Discussion:

Deemed Forest aka sacred groves

The Rajasthan government recently declared Orans (sacred groves) as deemed forests primarily in response to specific Supreme Court directives. The court, in a December 2024 judgement, ordered Rajasthan to identify, survey, and notify Orans and similar sacred groves as forest land, reflecting both their cultural significance and ecological value.

The term "deemed forest" is not explicitly defined in any statute, including the Forest Conservation Act (FCA) of 1980. The Rajasthan government was prompted to officially recognize Orans as forests by Supreme Court orders issued on December 18, 2024. The Supreme Court of India, in the landmark T N Godavarman Thirumalpad case (1996), adopted a broad interpretation of the terms "forest" and "forest land." It ruled that forest land includes all areas recorded as forest in government records regardless of ownership, and must be protected under the FCA provisions. The Supreme Court directed the state to grant legal protection to sacred groves (Orans), emphasizing these steps:

- **District-wise mapping and notification**: The Court instructed Rajasthan to carry out detailed, district-wise mapping—not based on the size of land, but on the ecological and cultural significance of Orans and similar sacred groves—and to notify them as forests under the Forest Conservation Act.
- **On-ground and satellite mapping**: The Forest Department was tasked with comprehensive on-ground and satellite mapping of all sacred groves (Orans, Dev-vans, Rundhs, etc.) to classify and notify them as forests.
- **Protection emphasis**: The Supreme Court underscored that Orans must be protected against encroachment and degradation, and suggested also taking steps for their protection under the Wildlife Protection Act, 1972, specifically as "community reserves" under Section 36-C.
- **Immediate compliance**: The Court criticized previous delays and ordered implementation of recommendations from the Central Empowered Committee for the classification and protection of these areas, dating back to a 2005 committee report and earlier Court directions in 2018.

- **Rationale and significance**: The orders highlighted Orans' ecological, spiritual, and cultural roles, stating their legal recognition as forests was urgently needed to safeguard community interests, biodiversity, and the critically endangered Great Indian Bustard.

There are multiple reasons for this landmark decision. The historical context lies in the fact that orans had been allocated for developmental projects especially in energy sectors and hence categorized as wastelands resulting into their degradation. The pressure to update records was also an obvious reason. The government had previously notified only a fraction of the state's estimated 25,000 Orans as protected areas. The Supreme Court order pushed for expedited official recognition and legal protection of these community-managed groves. The declaration responds to ongoing litigation and interim orders monitoring the implementation of the 1996 TN Godavarman judgement, which broadened the definition of forests to include such areas. Finally, the Supreme court mandate for the Rajasthan Government to protect to protect sacred groves as forests under the law, emphasizing the need for focused conservation due to their role as biodiversity hotspots, water recharge zones, and habitat for critically endangered species like the Great Indian Bustard. In summary, the Rajasthan government's decision was a direct consequence of the Supreme Court's instructions to formally recognize and safeguard Orans as deemed forests to uphold ecological, cultural, and legal obligations.

Sacred Groves as the carbon repository:

The landscape of Rajasthan already faces significant environmental challenges, including the pressing need for effective climate change mitigation strategies. In such case, the deemed forest, although small in numbers, plays a pivotal role in climate mitigation, when the earths average temperature has increased by approximately 1.1°C (2 °F) since the pre-industrial era (1850-1900). To limit global warming to 1.5°C, greenhouse gas emissions must peak before 2025 at the latest and decline 43% by 2030 (https://unfccc.int/process-and-meetings/the-paris-agreement). Hence, the preservation of sacred groves is essential for biodiversity, ecosystem health, and global carbon balance, making them valuable tools in the fight against climate change. Sacred groves enhance soil and biomass carbon over time primarily through the following mechanisms:

- **Protection from anthropogenic disturbance**: Sacred groves are preserved by cultural and religious beliefs, reducing activities like logging, grazing, and land conversion. This allows trees to reach maturity, supports continuous regeneration, and maintains dense, uninterrupted forest cover—key factors enabling long-term carbon accumulation in both vegetation and soil.
- **High biodiversity and structural complexity**: Groves typically harbor a rich diversity of tree species across multiple age classes. This diversity supports high levels of aboveground biomass, as mature trees store large amounts of carbon, and ongoing regeneration ensures the replenishment of carbon sinks as older trees die and decompose.
- **Efficient biomass carbon sequestration**: Sacred groves exhibit significantly higher tree biomass and carbon stocks than disturbed lands. Distinct species (like Ficus benghalensis, Azadirachta indica, and others) are particularly efficient at capturing and storing carbon.
- **Enhanced soil carbon accumulation**: The continuous deposition of leaf litter and organic material from undisturbed vegetation boosts soil organic carbon (SOC) pools. Sacred groves commonly outperform managed or degraded lands in soil carbon storage.

- **Healthy regeneration cycles**: The high density of seedlings and saplings, alongside an inverted-J tree diameter distribution, reflects ongoing regeneration and ecosystem health. This steady recruitment ensures that groves function as enduring carbon sinks, with younger trees compensating for biomass lost to natural senescence.
- **Stable, long-term carbon pools**: By fostering undisturbed forest growth and rich organic soils, sacred groves build both aboveground (living biomass) and belowground (soil organic matter, roots) carbon pools that remain stable—and may continue increasing—well beyond what is seen in disturbed or managed landscapes.

Factors influencing or favouring high carbon sequestration in groves:

Minimum human disturbance in the groves from cutting, grazing and other activities maintain the floral biodiversity, and intact the soil profile, thus enhancing carbon storage. The presence of mature tree of different species greatly boosts carbon capture and retained in both living and dead biomass. Rich, undisturbed soils with high organic matter improve root growth and stabilize stored carbon. Decomposition of litter and root biomass leads to greater soil organic carbon storage, especially in deeper soil layers. The long time and continuous protection of these grooves, rooted in religious or traditional values, ensures long-term preservation and recovery of these ecosystems, sustaining their carbon sink function. In combination, these factors enable sacred groves to act as long-term, stable, and efficient carbon sinks across diverse landscapes

Current carbon sequestration capacity of Rajasthan's sacred groves.

As per report by AFRI (2014), the sacred groves of Rajasthan vary widely in their floral and faunal diversity and in their inventory, 123 sacred groves selected from all districts of Rajasthan has recorded 131 woody species belonging to 48 families. However, there is currently no precise, peer-reviewed state wide estimate of the total carbon sequestration capacity of Rajasthan’s sacred groves due to variable size, condition, and insufficient documentation. However, available research and state forestry sources provide indicative figures and qualitative insights. Rajasthan is projected to have about 25,000 sacred groves, though only 10% are properly documented (Rathore, 2024). Well-maintained groves are noted as "best in accumulating soil organic carbon," particularly in agro-climatic zones IB and IV, with greater soil carbon density compared to other land uses. Actual biomass carbon storage and soil carbon density vary significantly by grove age, species, management, and disturbance. Older groves with mature trees and richer understory store considerably more carbon. Considering the typical woodland structure and state of Rajasthan's groves, total carbon storage per hectare is likely in the low to moderate range (approx. 10–40 t C/ha for intact groves), especially compared to wetter forest types in other states. Sequestration rate (annual carbon uptake) is lower in degraded or disturbed groves due to poor regeneration and species loss, as documented in the state's forestry reports.

Public perception towards government decision as deemed forest stature.

The people of Rajasthan have had a mixed response to the status of sacred groves (Orans) being declared as "deemed forests." While there is general recognition of their ecological and cultural importance, concerns remain about the adequacy and timeliness of formal protections. Despite the directive, only around 5,000 out of approximately 25,000 Orans have been notified so far, covering about 400,000 hectares, against an estimated 600,000 hectares of Oran land in Rajasthan. This slow pace has caused

anxiety and frustration among conservationists and communities who value these groves. The recent notification of Orans as deemed forests in February 2024 was welcomed as a positive step, but there are concerns that the amended Forest Conservation Rules of 2023 may dilute protections and restrict community access to traditional uses such as grazing, potentially affecting local livelihoods and customary rights. Local communities traditionally protect Orans through religious and cultural practices and view them as sacred spaces vital for biodiversity, water security, and cultural identity. However, some fear that state-led "deemed forest" status may lead to stricter control, limiting their traditional stewardship and access. The Supreme Court emphasized including local communities in the governance and protecting Orans as "community reserves" under the Wildlife Protection Act, ensuring ecological sustainability while respecting cultural connections. Overall, while the legal recognition of Orans as forests is seen as a major positive by many stakeholders, the full satisfaction of people depends on effective, inclusive, and timely implementation, balancing forest protection with community rights and livelihoods

4. Conclusion:

Rajasthan is among the Indian states rich in sacred groves, which serve as vital natural carbon sinks by preserving pockets of mature, undisturbed, and bio diverse vegetation. Estimated current carbon sequestration capacity per hectare is likely in the range of 10–40 tonnes of carbon per hectare for the better-conserved and mature sacred groves of Rajasthan, with lower values in degraded or smaller patches. These groves play an important role in climate change mitigation, contributing to India's net-zero target by 2070 thanks to their capacity for long-term carbon storage in both biomass and soil. The recent Supreme Court directives have ordered the mapping and formal recognition of all Rajasthan's sacred groves, which may help generate precise carbon stock estimates and improve conservation strategies in the future. Effective protection and restoration could substantially enhance this capacity, as undisturbed groves have proven carbon storage advantages over surrounding degraded lands.

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