

Age-Friendly River Ghats: Bridging Heritage, Accessibility, and Universal Design

Vedula Shanmuka Teja^{1*}, Srinivas Daketi²

Abstract

Public spaces shape social life, yet for older adults, accessibility is a matter of dignity and participation rather than convenience. Heritage-rich river ghats in India stepped waterfronts that support ritual, social, and daily needs are largely absent from age-friendly and accessibility research. This bibliometric and systematic review (2010–2025) examines 1,200 records from Scopus and Web of Science and conducts a focused qualitative synthesis of 162 India-context studies. Using VOSviewer for network mapping and inductive thematic coding, the study identifies four convergent research directions: universal design for inclusion, heritage management, blue-space health benefits, and smart-city technologies for non-invasive accessibility audits. Results reveal a pronounced disciplinary and typological bias: domestic research concentrates on green, flat recreational spaces while river ghats and heritage water architecture remain a structural research void. Policy analysis exposes a standardization trap in which universal accessibility standards (for example, 1:12 ramp requirements) are impractical for steep, historic ghats, producing legislative paralysis. The paper proposes a heritage-sensitive, justice-centered framework that combines non-invasive digital audits (IoT, LiDAR) with context-specific, reversible interventions: discreet handrails, micro-resting nodes, shaded seating, thermal mitigation, tactile cues, and crowd-management protocols for mass pilgrimages. Practical recommendations include a Heritage-Blue Space Policy Framework, a set of missing metrics (safe step geometry, thermal stress thresholds, crowd safety indicators), and a targeted research agenda prioritizing southern riverine ghats. Methodologically, the study combines quantitative bibliometric mapping with qualitative thematic synthesis to ensure both breadth and depth in findings. Findings are intended to inform urban designers, conservation authorities, and policymakers seeking equitable, culturally sensitive accessibility solutions. By bridging universal design and conservation, the study outlines pathways to make ghats culturally authentic and genuinely age-friendly, ensuring India's riverfronts remain timeless and ageless.

Keywords: Age-friendly environments, river ghats, universal design, heritage management, blue spaces

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INTRODUCTION

Public spaces are frequently described as the city's "living room," defining how communities interact, celebrate, and sustain local culture. However, for older adults, physical design often draws a sharp line between inclusion and isolation [1], and India's shifting age structure intensifies this challenge [2]. Globally, the World Health Organization's (WHO) "Age-Friendly Cities" framework has prioritized this issue [3, 4] and the WHO's World Report on Ageing and Health further links built-environment interventions to healthy aging outcomes [5]. Yet distinct gaps remain.

Significant ambiguity exists regarding how to apply these modern frameworks to the complex, historic precincts of the Global South—specifically, India’s river ghats.

A river ghat is not merely physical infrastructure; it serves as a socio-spiritual lifeline. For millions of elderly Indians, these steps are vital sites of daily ritual, social bonding, and spiritual solace [6]. However, the geometry of a ghat is inherently hostile, characterized by steep gradients, uneven stone paving, and a lack of handrails. This reality creates a fundamental conflict between heritage conservation, which demands the preservation of historic fabric [7], and universal design, which mandates inclusivity [8].

The current literature largely overlooks this conflict. Global research on “blue spaces” is predominantly fixated on the West, focusing on recreational beaches, marinas, and leisure walks [9, 10]. Even within the Asian context, the focus remains on “sanitized” urban regeneration, often viewing the waterfront as a political project rather than a social necessity [11].

In India, the data appear equally skewed. While extensive studies exist regarding “green spaces” and parks in Tier-II cities [12, 13], the river ghat remains unmapped. There is a scarcity of rigorous data on adapting these ancient water structures for a modern, aging population without compromising their archaeological integrity [14].

This study addresses the structural hole. By analyzing 1,200 publications (2010–2025), this study maps this disconnect. It is argued that the solution lies not in concrete ramps or invasive construction, but in the application of “Smart Accessibility Audits.” Utilizing non-invasive digital tools, such as IoT and LiDAR, to identify barriers [15] allows for the reimagining of the ghat as an inclusive space for intergenerational equity.

DATA COLLECTION

The objective of this study was not merely to quantify publication output but to identify structural gaps in the field. To achieve this, a dual approach was adopted: a broad bibliometric analysis to map global trends and a deep systematic literature review (SLR) to uncover local nuances. This strategy draws on protocols from recent blue space research [16], ensuring that the findings are both statistically significant and contextually grounded.

Search Strategy (PRISMA 2020 Protocol)

Data were harvested from two primary high-impact databases: Scopus and Web of Science (WoS). These platforms were selected for their rigorous coverage of urban planning and public health. The search timeline was restricted to 2010–2025, a deliberate choice to capture the evolution of the WHO “Age-Friendly Cities” framework and its application to waterfront projects [17], in light of recent UN population projections that underscore the accelerating pace of population aging [2].

Search strings targeted the intersection of three specific clusters:

- *Who*: “Older adults,” “Aging,” “Elderly.”
- *Where*: “Blue spaces,” “Riverfronts,” “Ghats,” and “Public Spaces.”
- *How*: “Universal Design,” “Heritage Conservation,” and “Smart City” [18].

Study Selection and PRISMA Flow

Following the PRISMA 2020 guidelines ensured transparency in the selection process.

- *Identification* ($n = 1,450$): The initial search yielded 1,450 records.
- *Screening* ($n = 1,200$): After removing duplicates and erratic metadata, a core library of 1,200 unique publications was retained for macro-level bibliometric mapping.
- *Inclusion* ($n = 162$): To isolate the “Indian Context,” abstracts were re-screened. Clinical geriatric studies and indoor experiments were excluded, resulting in 162 articles for deep qualitative synthesis. This facilitated the identification of “structural holes” that automated tools might miss [19].

Instrument and Analysis

Quantitative (VOSviewer)

Metadata from the 1,200 records was processed using VOSviewer (Version 1.6.19). This tool generated network maps to visualize keyword connectivity. Crucially, it revealed visual “silence”—terms like “Heritage” and “Accessibility” rarely appeared in the same cluster [20] Figure 1.

Qualitative (Thematic Analysis)

A manual Thematic Content Analysis was performed on the final 162 papers. This involved inductive coding to categorize data into four themes: health benefits, heritage conflicts, policy gaps, and smart interventions. This synthesis was key to deconstructing why Western models of “active aging” fail to address the specific “ritual mobility” of Indian Ghats [21, 22] Figure 2.

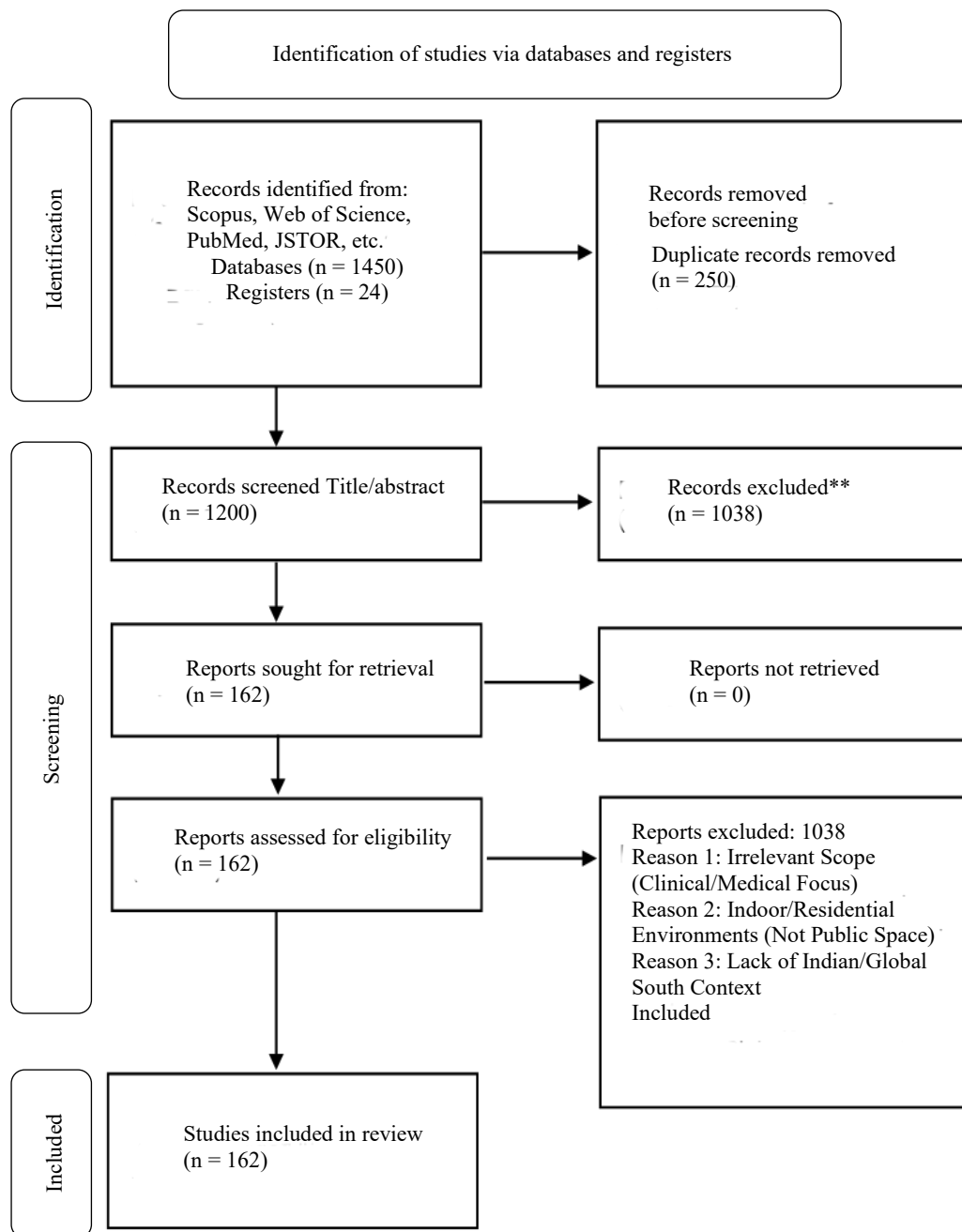


Figure 1. PRISMA flow summary for study identification, screening, and inclusion (2010–2025) [20].



Links: 85 Total link strength: 300 Occurrences: 42

Figure 2. Bibliometric mapping of keyword co-occurrences (n=1,200) revealing the thematic disconnect between “India” and “Blue Spaces.”

ANALYSIS

The “Green” Bias

The analysis reveals a distinct “typological bias.” Academic discourse is heavily concentrated on green spaces (parks) and coastal blue spaces (beaches) [23], largely ignoring the complex middle ground. Research focuses heavily on flat, paved environments designed for leisure walks [24], even though blue-space literature documents distinct health pathways that are not captured by park-centric studies [25].

In India, this bias is pronounced. While ample data exists on “thermal comfort in parks” or “walking safety on streets” [13], river ghats are virtually invisible in the data. Despite being socio-spiritual lifelines, they remain unstudied. While cities like Hong Kong have begun linking “blue and green” infrastructure, the focus remains on modern, planned waterfronts rather than historic realities [21].

Interpretation

The network visualization provides empirical evidence of the “Green Bias.” The map splits into two distinct clusters:

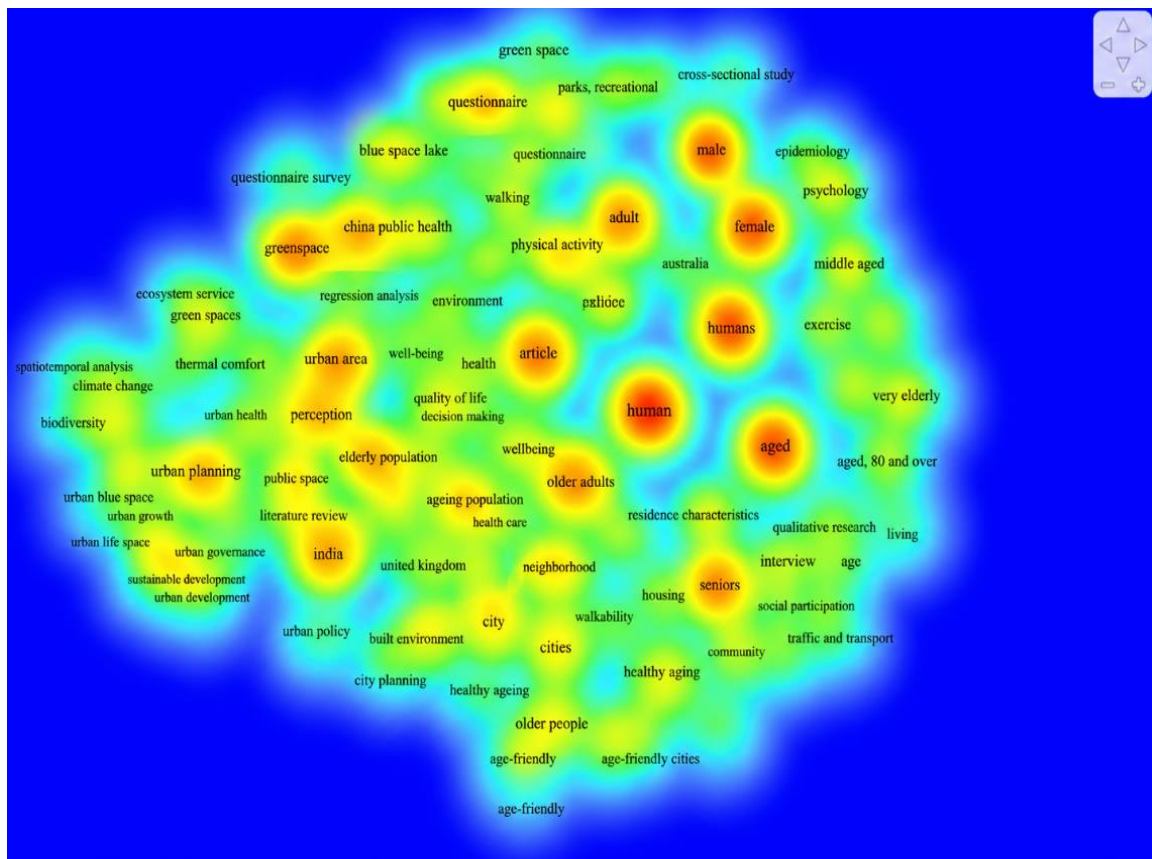


Figure 3. Density visualization (Heat Map) of research saturation. red/orange zones indicate high publication density; blue zones indicate low density.

- *The red cluster (urban planning):* Dominated by terms like *India*, *urban planning*, *greenspace*, and *elderly population*. The strong link strength between “India” and “Greenspace” confirms that domestic research is heavily skewed toward parks.
- *The blue/green cluster (health):* Terms like *blue space* and *wellbeing* appear on the periphery, disconnected from the Indian urban planning cluster.
- *The structural hole:* Critically, despite the node “India” being central, it has zero significant linkages to “River,” “Ghat,” or “Heritage.” This visualizes the structural void: Indian age-friendly research is effectively “land-locked,” ignoring the water infrastructure that defines its cities.

The density visualization acts as a “thermal scan” of the academic landscape. (Figure 3) It reveals a distinct “saturation asymmetry.”

- *The “green” saturation:* The map shows intense heat (orange/yellow) around “Urban planning” and “Greenspace”, confirming that land-based recreational infrastructure is the dominant paradigm in current literature.
- *The “blue” coolness:* In contrast, “blue space” appears in a cooler green zone, indicating significantly lower research volume.
- *The “heritage” void:* Most critically, terms related to “River Ghats” or “Heritage Water Architecture” are effectively invisible, dissolved into the deep blue background. This confirms that while general “Urban India” (Orange node) is being studied, its specific hydro-cultural heritage remains a research void.

The “Standardization Trap”

A critical flaw is identified in the Harmonized Guidelines (2021) [26]. These regulations mandate 1:12 ramps, whereas historic ghats often feature gradients of 1:2. This creates a “standardization trap,”

where frameworks assume a modern urban fabric and offer no solutions for heritage zones. The result is “legislative paralysis”: accessibility is legally mandated [27] but practically unimplemented due to restrictions on altering historic stone embankments [11].

Heritage vs. Habilitation

A clear “governance silo” is evident. Heritage Conservation prioritizes the preservation of stone fabric, while public health prioritizes senior safety [7]. These disciplines rarely intersect. Conservation protocols often restrict handrails to protect visual integrity, while health experts demand safety features. Consequently, the ghat remains inaccessible as neither sector offers a compromise.

The Ritual Gap

Global studies predominantly frame “activity” as exercise—such as jogging or walking [28]. However, for the Indian elderly, the ghat is a site for sedentary ritual—sitting for prayer, meditation, or ablution [29]. Current data fail to capture these usage patterns, leading to designs focused on movement rather than stillness [19], despite evidence that blue spaces support both active and contemplative salutogenic experiences [25].

The Metropolitan Bias

Even within the Indian context, the geographical distribution of research is skewed.

- *North (Delhi)*: Focuses on neighborhood parks as social safety nets, often ignoring the Yamuna riverfront.
- *West (Nagpur/Mumbai)*: Utilizes parameters such as “Local Climate Zones” (LCZ) but applies them to concrete structures rather than open riverbanks [19].
- *East (Kolkata)*: Despite being a riverine city, studies track “Adda” (socializing) in parks, overlooking the Hooghly Ghats entirely [13].

Table 1. Regional distribution of studies: key cities, dominant research domains, variables, and identified gaps.

Region	Key cities studied	Dominant research domain	Key variables and parameters	Identified gaps (the “structural hole”)
Northern Region	Delhi, Chandigarh	Social Gerontology in Green Spaces: Focuses on parks as sites for social bonding to combat isolation.	• <i>Social</i>: Peer interaction frequency, loneliness scales. • <i>Climatic</i>: Thermal comfort (PET/UTCI) in open spaces.	The “Blue” Void: Despite the Yamuna River’s presence, research focuses solely on <i>green</i> neighborhood parks.
Western Region	Mumbai, Pune, Ahmedabad	Environmental Comfort and Urban Design Heavy focuses on physical planning standards and climatic adaptation.	• <i>Environmental</i>: Local Climate Zones (LCZ), Vegetation Index (NDVI). • <i>Physical</i>: Street connectivity metrics.	The “Heritage” Disconnect: Studies measure <i>modern</i> recreational spaces (e.g., Sabarmati) but exclude traditional stepped Ghats.
Southern Region	Bengaluru, Chennai	Spatial Equity and Exclusion: Analyzes how urban sprawl and peripheral development exclude the elderly.	• <i>Spatial</i>: Distance to nearest park (400 m rule). • <i>Mobility</i>: Transit access for the “immobile” elderly.	The “Ritual” Gap: Focuses on <i>active</i> recreation (walking) rather than <i>sedentary</i> ritual activities common in temple tanks.
Eastern Region	Kolkata	Gendered Social Spaces: Specific focus on how “Adda” culture manifests in parks.	• <i>Sociological</i>: Gender-segregated use of space. • <i>Psychological</i>: Sense of belonging.	The “River” Paradox: Kolkata is a river city, yet literature maps the <i>park</i> as the primary social node, overlooking the Ghats.

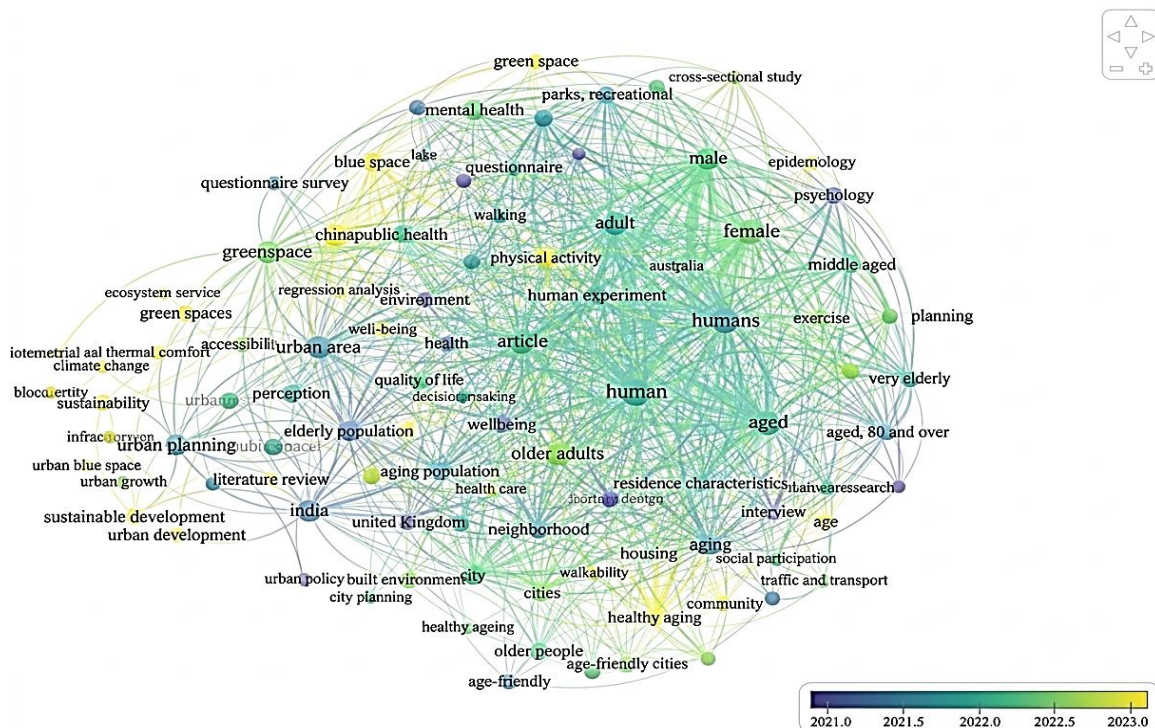


Figure 4. Temporal overlay visualization of research trends (2010–2025) (blue nodes = older topics; yellow nodes = emerging topics).

The “Sabarmati Model”

This represents the “sanitized” riverfront concrete, which is flat and modern and has received the bulk of research attention owing to its measurability [11] Table 1.

The Southern Blind Spot

Most critically, no rigorous studies were identified regarding the massive ghats of the Krishna and Godavari Rivers (Vijayawada, Rajahmundry). Despite hosting millions of elderly pilgrims during *Pushkaram*, these “hydro-cultural” hubs are absent from the literature. This oversight fails to document the unique challenges of the South, where steep, flood-resilient steps meet the specific mobility needs of the aging population (Figure 4).

This visualization exposes a critical “Innovation Lag.” While global research has shifted toward yellow/green nodes such as “Blue space” and “Sustainable development” (indicating recent focus), the node “India” remains blue (older average publication year). This suggests that domestic literature is stuck in older paradigms. To bridge this temporal gap and align with global standards, India must leapfrog into modern methodologies—specifically, the “Smart Accessibility Audits” proposed in this study.

CONCLUSIONS

The Demographic Imperative

India is aging. As our demographics shift, the physical environment is no longer just a backdrop; it determines public health. The “Age-Friendly” framework has done excellent work, highlighting green spaces. However, it missed the “Blue City” specifically: the river ghats. For the Indian elderly, these are not just steps to water. They are lifelines.

They are essential for ritual, social bonding, and mental peace. Excluding them from the accessibility conversation is not just a design flaw. It is cultural erasure. We are currently designing for “active aging” on a treadmill, when we should be designing for dignity at the water’s edge.

The “Ghat” as a Frontier

Our data confirms a hard truth: current policy frameworks are built for the West. They assume flat land and modern concrete. They fail when faced with the steep, uneven geometry of a historic ghat. We cannot force a 1:12 ramp onto a 1:2 stone slope. We need a new rulebook. We need a specialized “Heritage-Blue Space Policy Framework” that prioritizes justice-centered access over political beautification.

The Road Ahead

This paper is a call to action. Future research must move from theory to measurement. We need to define the “missing metrics”:

- *Geometry*: What is the “safe limit” for a steep step when a ramp is impossible?
- *Comfort*: How does the burning heat of stone affect an 80-year-old pilgrim? We need to quantify this thermal stress.
- *Safety*: How do we manage crowds during *Pushkaram* without crushing the vulnerable?

Final Thought

We do not want to turn Varanasi into a modern mall. We want to decode its complexity. By filling these data gaps, we can ensure that India’s riverfronts remain timeless but become finally ageless.

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